International Space Station Program

D684-13037-01

EVA Analysis Report

AMS PPAS and S3 PAS UMA

Type 4 Document

11/12/2008

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REVISION AND HISTORY PAGE

Rev.	Description	SSCN	Analyst	Pub. Date
-	Initial Release	010446	Mariana Monsalve	12-09-08

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PREFACE

The D684-13037-01 is an internal Prime Contractor document and is not required for delivery to NASA. This document is controlled by the EVA&CSI Team and any changes to this document must be approved by the EVA&CSI Team.

/s/ Terri B. Puckett
Manager

12-1-08
Date

INTERNATIONAL SPACE STATION PROGRAM
EVA Analysis Report
AMS PPAS and S3 PAS UMA
11/12/2008

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INTERNATIONAL SPACE STATION PROGRAM
EVA Analysis Report
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LIST OF CHANGES

All changes to paragraphs, tables, and figures in this document are shown below:

REVISION	DATE	CHANGES

EVA Analysis Report

Title: AMS PPAS and S3 PAS UMA **EVAP:** 0348

Type: Maintenance **Flight:** **Element:** S3

Description

The Umbilical Mechanism Assembly (UMA) is used to mate the electrical and data interfaces between the Alpha Magnetic Spectrometer (AMS) and Starboard Truss Segment 3 (S3). The Passive UMA is attached to the AMS Passive Payload Attach System (PPAS) and the Active UMA is attached to the S3 Payload Attach System (PAS). Nominally, the Active and Passive UMAs are mated and demated remotely. For contingency, an Extravehicular Activity (EVA) Override Bolt is on the Active UMA.

This analysis determines whether the EVA requirements are met for three sets of tasks involving the Active and Passive UMAs. The first task analyzed is the actuation of the Active UMA EVA Override Bolt. The second task analyzed is the removal of the Active UMA. This allows access to remove the Passive UMA. The third task analyzed is the removal of the Passive UMA.

These tasks are free-float and Articulating Portable Foot Restraint (APFR) based.

Generic Notes

Number	Description
1	All requirements verified, except the Remote Manipulator System (RMS) outfitting requirement, are detailed in the Extravehicular Activity (EVA) Analysis Report (EAR) Companion, A3-J083-DEA-M-9601527-Rev D, dated 16 January 1997. The EAR companion lists rationale for assigning requirement compliance, non-compliance, or non-applicability for a given task.
2	Verification of crewmember view of worksite is done by graphical analysis. If there is no interference with lines drawn from the eye points of 50th percentile American female, 50th percentile American male and 95th percentile American male and the worksite and those lines fall within the crewmember's field of view (see EAR Companion), field of view requirements are deemed verified.
3	For Shuttle Remote Manipulator System (SRMS) and Space Station Remote Manipulator System (SSRMS) based tasks, ingress/egress aids are not required to be provided on the structure due to the availability of the Portable Foot Restraint (PFR) Workstation Stanchion (WSS) on the Articulating Portable Foot Restraint (APFR).
4	Unigraphics (UG) EAR has been approved by Boeing Prime as a valid method for verification of the twelve Prime Item Development (PID) requirements listed in the EAR Companion (see Design Analysis Cycle 2, TDS 3.1.14-3). The RMS outfitting requirement was not included in this approval, but is included in this report for System Level verification. Areas/components not suitable for verification via current UG analysis are: dexterity/tactility, mass handling, forces and torque in multiple axes for hardware with a volume greater than 5 cubic feet and/or a mass greater than 50 lb., alignment tolerances, use of nonstandard controls and indicators, mental and physical fatigue levels, operational functionality, timeline determination, and manipulation of flexible hardware (i.e. cables, umbilicals, tethers).
5	Crew and Equipment Translation Assembly (CETA) cart locations are shown based on the Y0 position (in centimeters) of the port edge of the CETA cart per Space Station Program (SSP) 30256. Nadir and Zenith swing arm locations are indicated by a position number.
6	For tasks based on the RMS, refer to the Manipulator Analysis - Graphic, Interactive, Kinematic (MAGIK) report listed in the "References" section for the RMS positions.
7	This analysis assumes all mechanisms are compliant with EVA force requirements.
8	This report is used to verify EVA requirements. Actual operational procedures may vary due to crew preference, operational constraints, and the use of non-baselined EVA hardware and techniques.
9	This analysis was conducted per process HOU-EGD-066, EVA&CSI Graphical Analysis Process. The analysis process is documented in the Boeing Houston Procedure Documentation System (PDS).
10	Any illustration shown in the "Procedural Steps" section does not constitute as requirement verification. These illustrations represent the UG models, which were used for the requirement verification in this report.
11	The illustrations taken for this analysis were created from the UG part file that corresponds to the document number of this report. Refer to HOU-EGD-066 for the location of the file.
12	Positions that are identical to previously analyzed positions (meaning it has the same platform and APFR settings) are not re-evaluated. Therefore, the compliance information may not be present and the reader is directed to the analysis of the previous position. This is the typical situation for remove and replace (R&R) operations in which one step removes an item and the replacement step is the reverse. This keeps the compliance matrix concise without redundant positions.

13 For a free float task, the Dedicated Worksite Outfitting, the Work Envelope, APFR Ingress, and Stability Aid requirements do not apply because they are all based on a foot restraint. However, the UG graphical envelopes for the Work Envelope and Stability Aid are used to verify the Free Float Outfitting requirement. The APFR Installation requirement only applies when showing the installation of the APFR from the Free Float position.

14 All EVA Tools listed in the "Tools Used" section of the steps are configured prior to the tasks described in this analysis.

15 The Three Dimensional (3D) graphical models used to verify the EVA requirements in this analysis are results of the efforts made by the EVA & Crew System Integration (CSI) Team to obtain accurate models from the International Space Station (ISS) 3D Computer Aided Design (CAD) Team. These models reflect the as-designed configuration. If the necessary models are not available from the ISS 3D CAD Team, then they are obtained from the hardware designers, released drawings or other documentation from the hardware designers.

16 The Dedicated Worksite Outfitting requirement will be marked non-compliant if the APFR Installation, APFR Ingress and/or Stability Aids requirement are marked non-compliant. When the APFR Installation, APFR Ingress and/or Stability Aids requirements are granted an exception, then the Dedicated Worksite Outfitting requirement will be marked compliant with exception.

17 The EVA Analysis and Integration Team (AIT) prefers that EVA Analysis Reports do not use the Worksite Interface (WIF) Extender as a platform unless National Aeronautics and Space Administration (NASA)-EVA Office plans to use the WIF Extender on-orbit and NASA-EVA Tools has concurred. This preference was explained during the EVA AIT on June 13, 2006.

Assumptions

Number	Description
1	ExPRESS Logistics Carrier-2 (ELC-2) is attached to S3 Zenith Outboard (Starboard) PAS.
2	AMS is attached to S3 Zenith Inboard (Port) PAS.
3	The anti-rotation cap over the Active UMA EVA Override Bolt has been removed.
4	The Floating Potential Measurement Unit (FPMU) is not occupying S1 Camera Port (CP) 2.

Notes

Number	Step	Note
1		For this analysis, the ISS Coordinate System (CSYS) is used.
2		Step Summary: Step 1 applies to the actuation of the Active UMA EVA Override Bolt (Contingency Operation). Steps 2-6 apply to the removal of the Active UMA on S3. Steps 7-9 apply to the removal of the Passive UMA on AMS.
3		Steps 3 and 4 apply to the removal of the Lower and Upper Brackets. These brackets are removed to aid the crew when accessing the Active UMA connectors. Therefore, the removal of these brackets is performed only if the crew prefers that they be removed.
4		The order of disengaging the Active and Passive UMA bolts is a recommended sequence.
5		Structures and Mechanisms and Thermal concurrence for the statement that the PAS can be used as a stabilization aid was provided in MDC 97H0479 Sections 1.0 and 8.4 and MDC 99H0286 Section 5.1.1. EVA Analysis Report MDC 96H0576 also explains concurrence in Note 7-6.
6		The following items do not have flight labels. Labels were assigned to each item for reference only and are shown in the Hardware Familiarization section of this report. 1) Brackets and Bolts 2) Clamps 3) UMA Bolts
7		Physical Properties: Active UMA Envelope Dimensions = 16.8 inches X 19.7 inches X 21.3 inches Active UMA not to exceed weight with harness = 76 lbs. (Resource SP-M-601) Passive UMA Envelope Dimensions = 10.8 inches X 11.6 inches X 12.1 inches Passive UMA not to exceed weight without harness = 16 lbs. (Resource SP-M-601)
8		For installation of the Passive UMA, report MDC 99H0487 (Note 6) recommends that Passive UMA bolts be engaged one side at a time and not diagonally.
9		The Active UMA must be removed before the Passive UMA can be removed.

10 Nominally, the Active and Passive UMAs are demated remotely. For contingency, an EVA Override Bolt is on the Active UMA. If these two methods fail to demate the Active and Passive UMAs, it is possible to remove the Active and Passive UMAs while they are mated. Refer to Hardware Familiarization image titled "UMA Interfaces (mated)" to see the configuration of the UMAs mated.

To accomplish the removal of the Active and Passive UMAs while they are mated, the tasks would be Step 2 through Step 9 except the task of removing the Active UMA would be removed from Step 6. The removal of the Active and Passive UMAs as one unit would occur after Step 9.

Related Drawings

Number	Rev.	Title
1F70141	F	MECHANISM ASSEMBLY, UMBILICAL, ACTIVE, ELECTRICAL - PAS
1F70157	F	PAYLOAD ATTACH SYSTEM ASSY, SEGMENT S3
1F70162	F	UMBILICAL MECHANISM, PASSIVE HALF-ULC
SEG39135720		ALPHA MAGNETIC SPECTROMETER
SEG39135812	-	PAS ASSEMBLY, AMS PAYLOAD ASSEMBLY

References

Reference Number	Rev	Title
57213-0004	-	AMS (Alpha Magnetic Spectrometer) On-orbit Operations Envelope Exceedance
57213-0006	-	Exception to AMS Working Volume Violation
A3-J083-DEA-M-9601527	D	EAR Companion Rev D (EVA Worksite Analysis Report Companion)
BOE-00006_SSP57003	-	S3 Exceptions to the Working Volume Requirements in Support of the AMS Payload
BOE-00007_SSP57003	-	S3 Exceptions to the EVA Crewmember Field of View Requirement in Support of the AMS Payload
BOE-00008_SSP57003	-	S3 Exceptions to the Spacing for Worksites-Above and Below (Stability Aid Height Considerations) Requirement in Support of the AMS Payload
BOE-00010_SSP57003	-	S3 Exceptions to the External Task Location (Crewmember Work Envelope) Requirement in Support of the AMS Payload
CB-02-043	-	Temporary Equipment Restraint Aid (TERA) NBL Development Test
CB-02-129	-	Columbus and Alpha Magnetic Spectrometer (AMS) Payloads NBL Development Test
D684-12654-01	-	EVA Analysis Report: EVA Aids on S3
D684-12700-01	-	EVA Analysis Report: ESP-3 PCAS and P3 UCCAS UMA
D684-13038-01	-	EVA Analysis Report: S3 EVA Secondary Translation Path With AMS Installed
EVA AIT Minutes 9-4-2008	-	Minutes for September 4, 2008 EVA AIT
HOU-EGD-066	-	EVA&CSI Graphical Analysis Process
MAGIK_AI_2279	A	AMS Installation
MDC 96H0578	D	S3/P3, Attach Structure (AS) Instl. (Attach Payloads/UCC)
MDC 97H0479	C	Comman Attach System (CAS) Structural Integrity Report
MDC 99H0286	-	International Space Station P3 and S3 Segment PTCS Verification Analysis Report
MDC 99H0487	A	S0, Umbilical Mating Adapter (UMA) Passive Half Remove and Replace
MDC96H0576	E	Layout, EVA Analysis S3/P3, Faces 3,4,5 Miscellaneous Maintenance
SP-M-601	D	CONFIGURATION ITEM SPECIFICATION FOR THE UMBILICAL MECHANISM ASSEMBLY
SSP57213	-	Alpha Magnetic Spectrometer-02 (AMS-02) Hardware Interface Control Document

Initial and Final Conditions

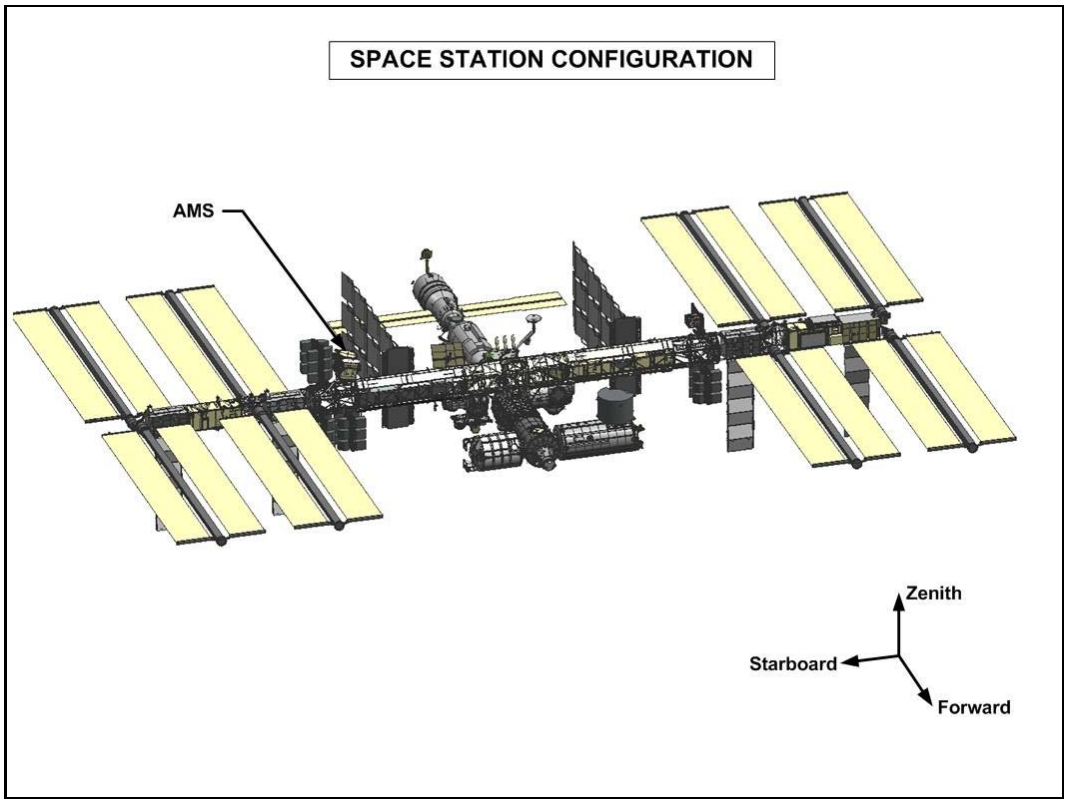
Number	Item	Initial Condition	Final Condition
1	Active UMA	Installed on S3 PAS	Removed from S3 PAS

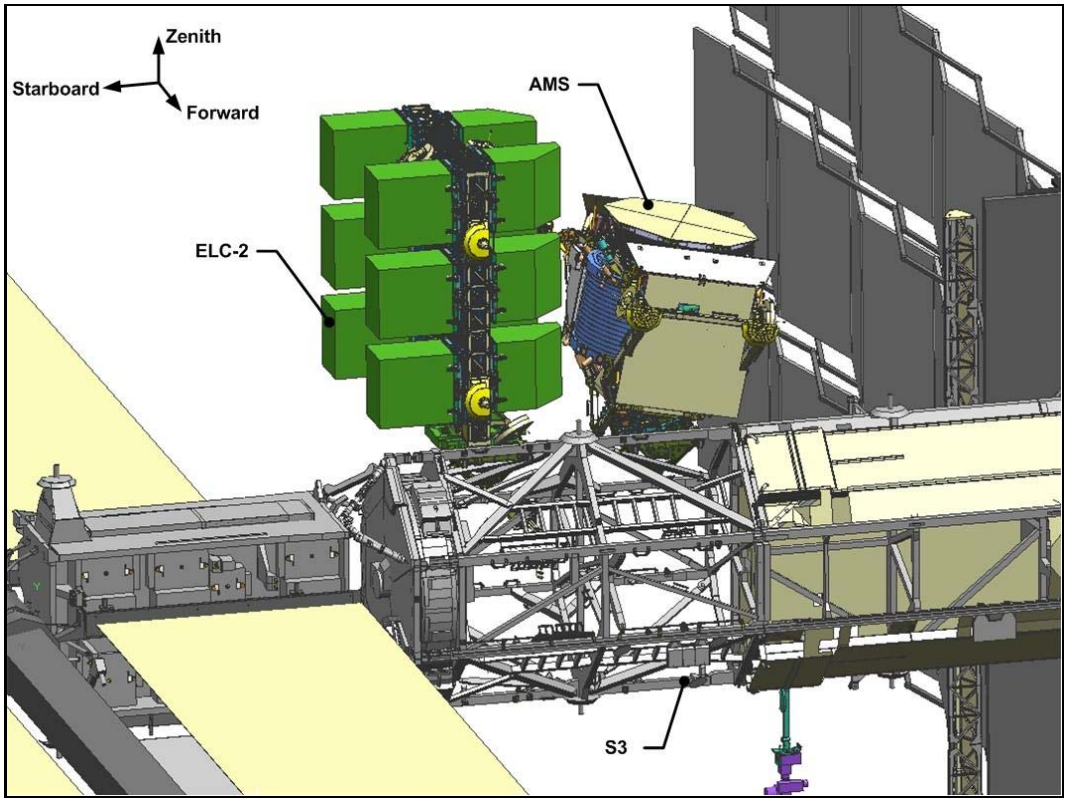
2	Passive UMA	Installed on AMS PPAS	Removed from AMS PPAS

Operational Constraints

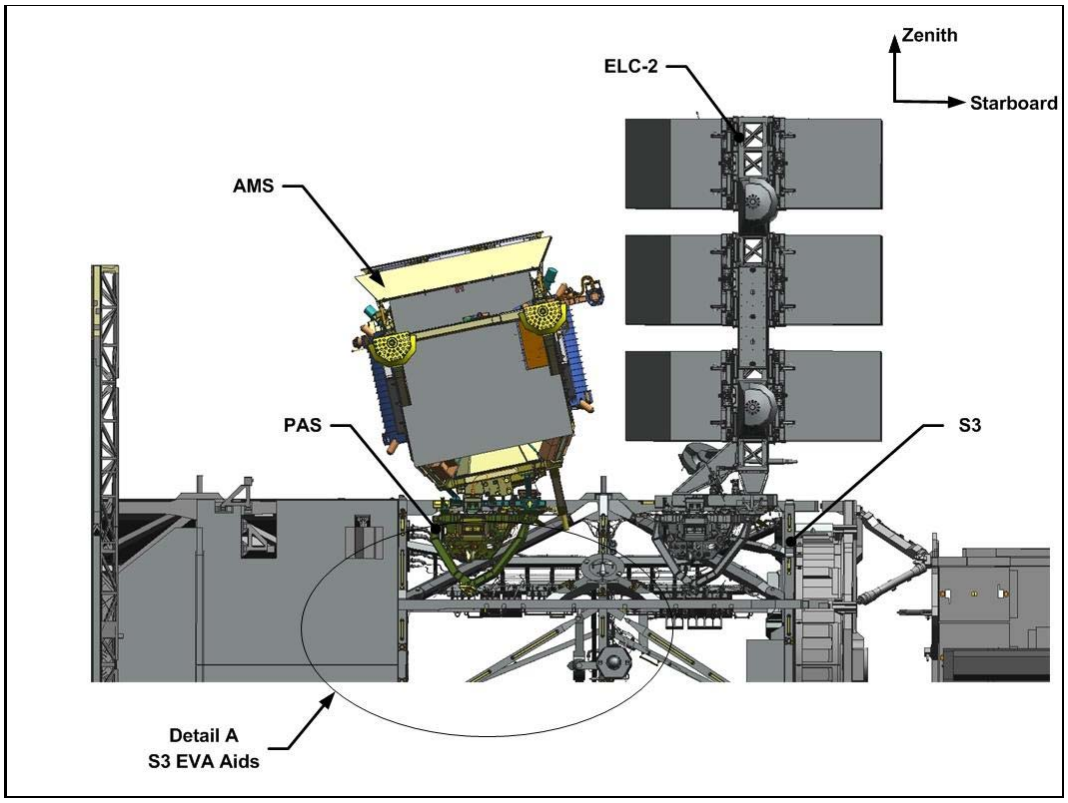
Number	*Title*	*Description*
1	Active UMA	Anti-Rotation Cap on the Active UMA EVA Override Bolt is removed.

International Space Station Configuration

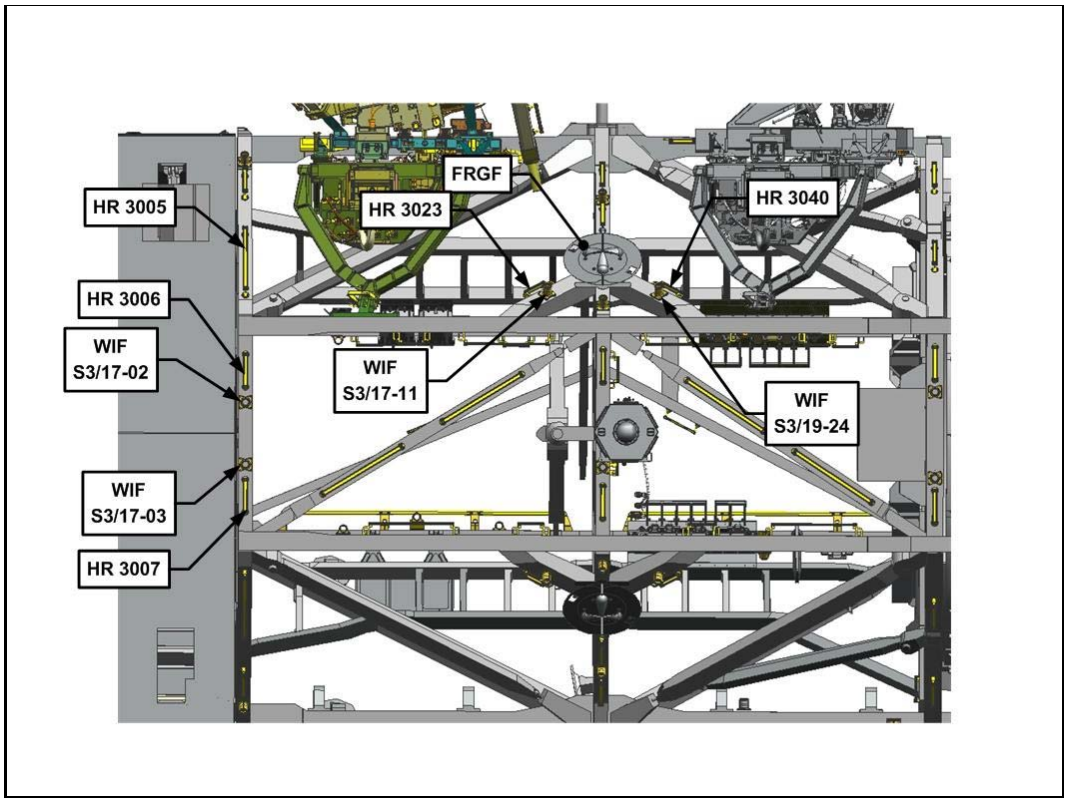




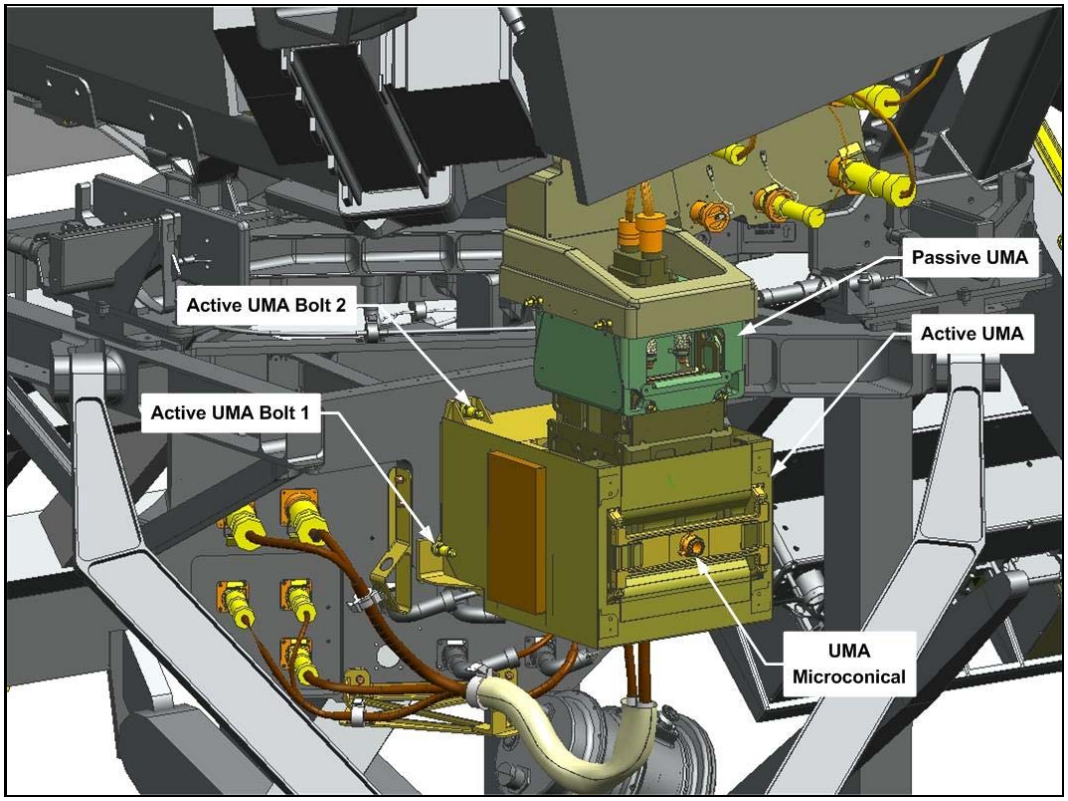
Hardware Familiarization



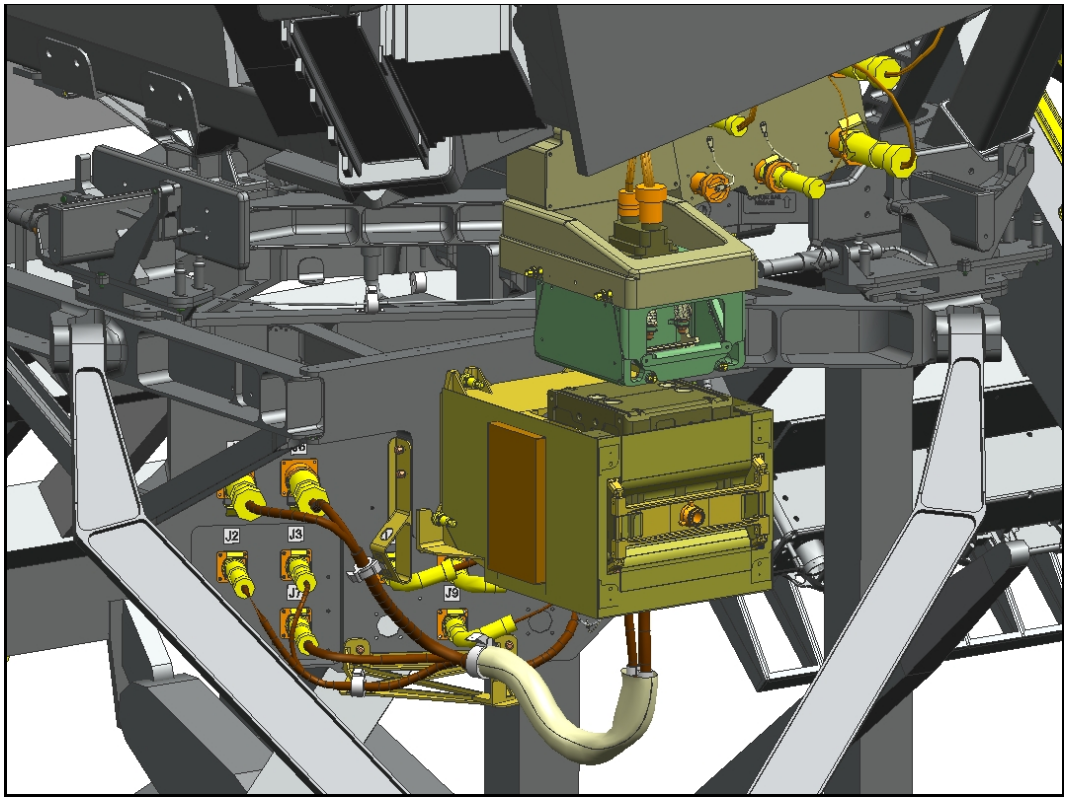
S3 Configuration



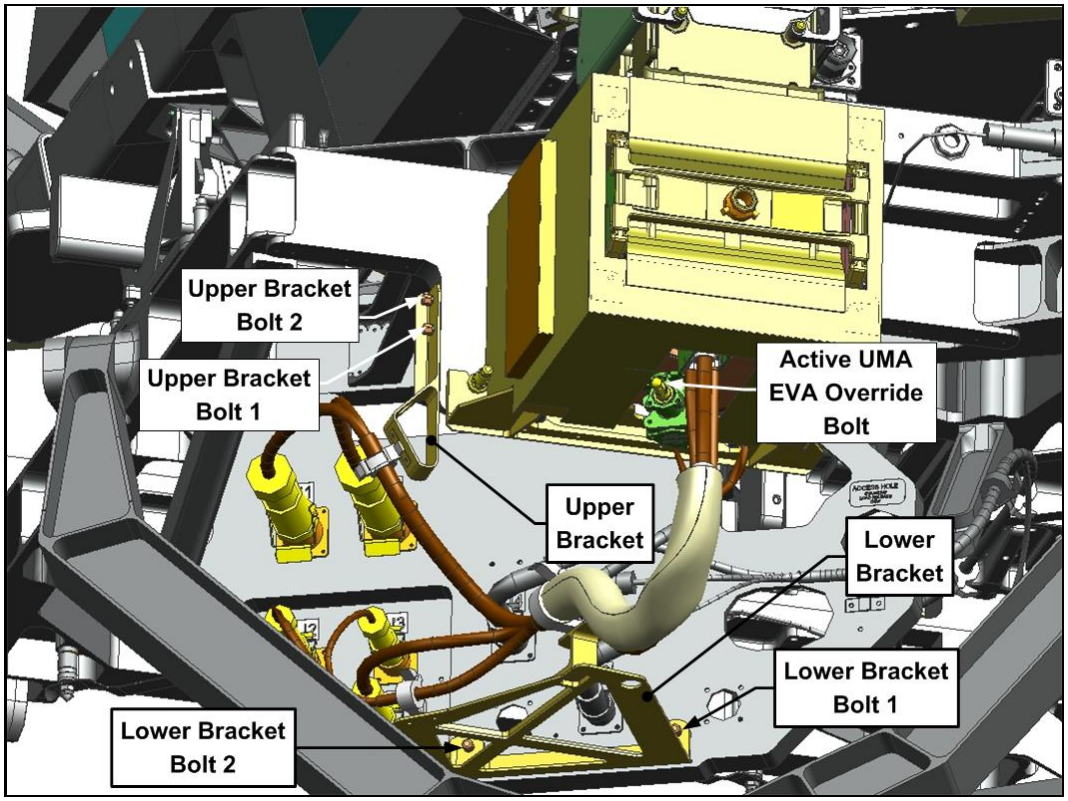
S3 EVA Aids



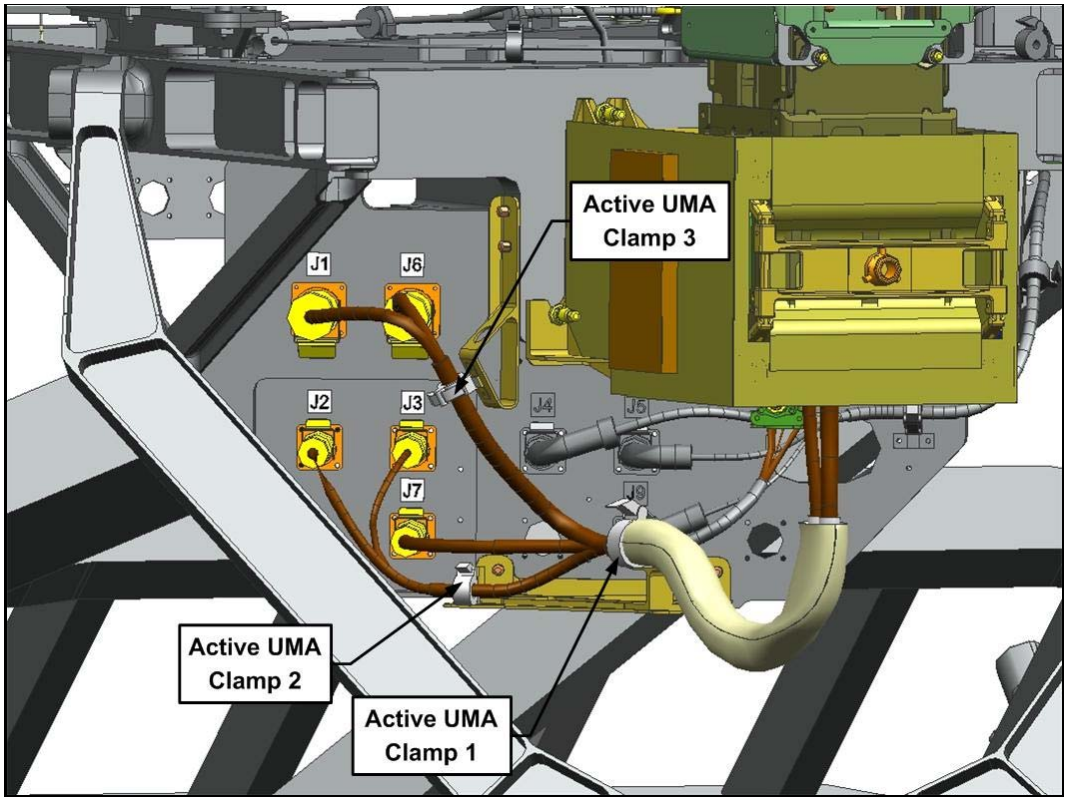
UMA Interfaces (mated)



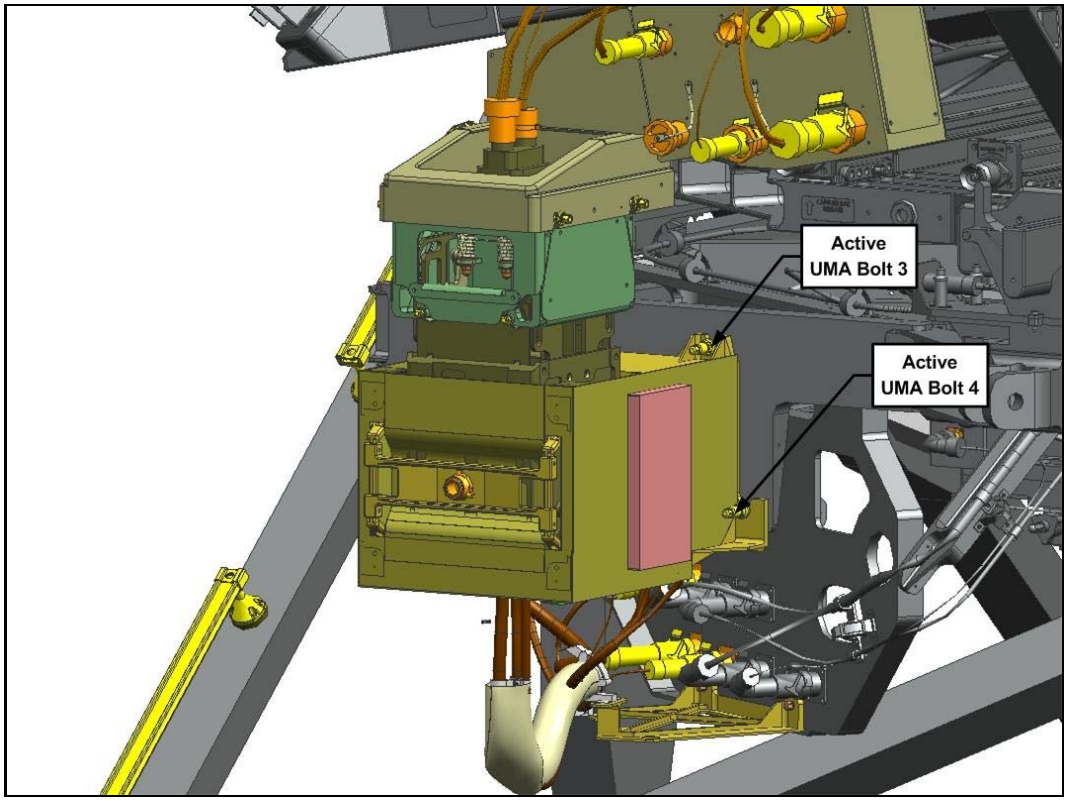
UMA Interfaces (demated)



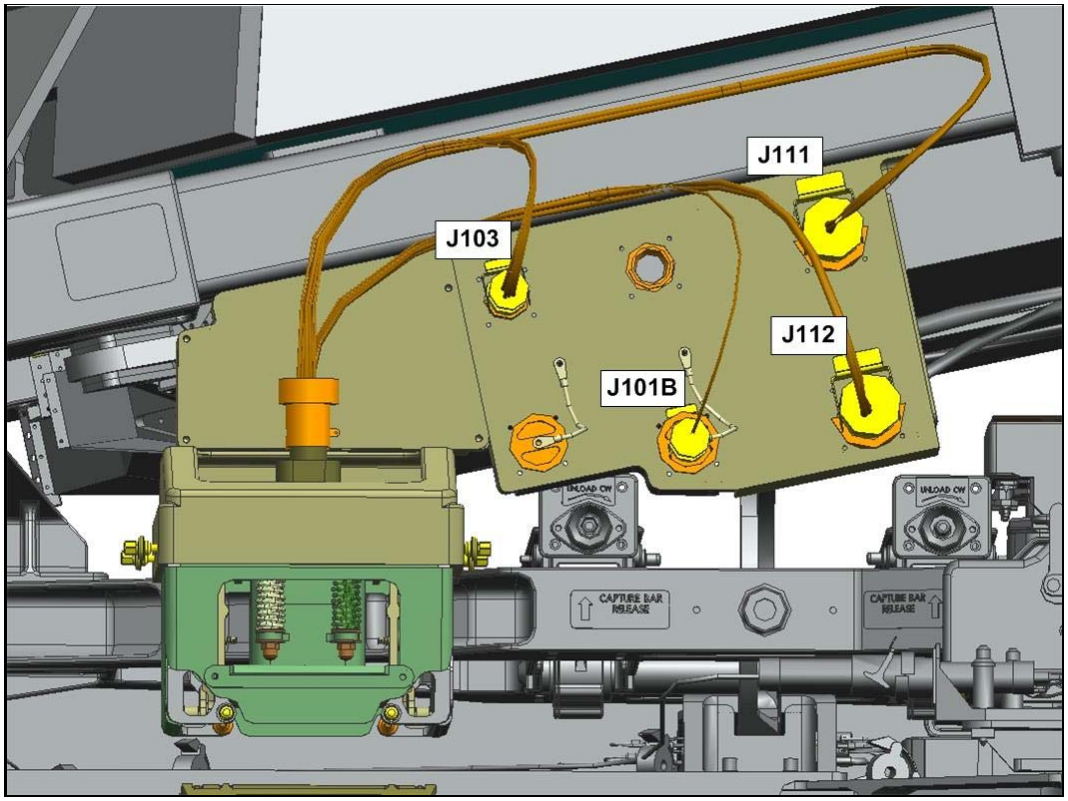
Active UMA Interfaces



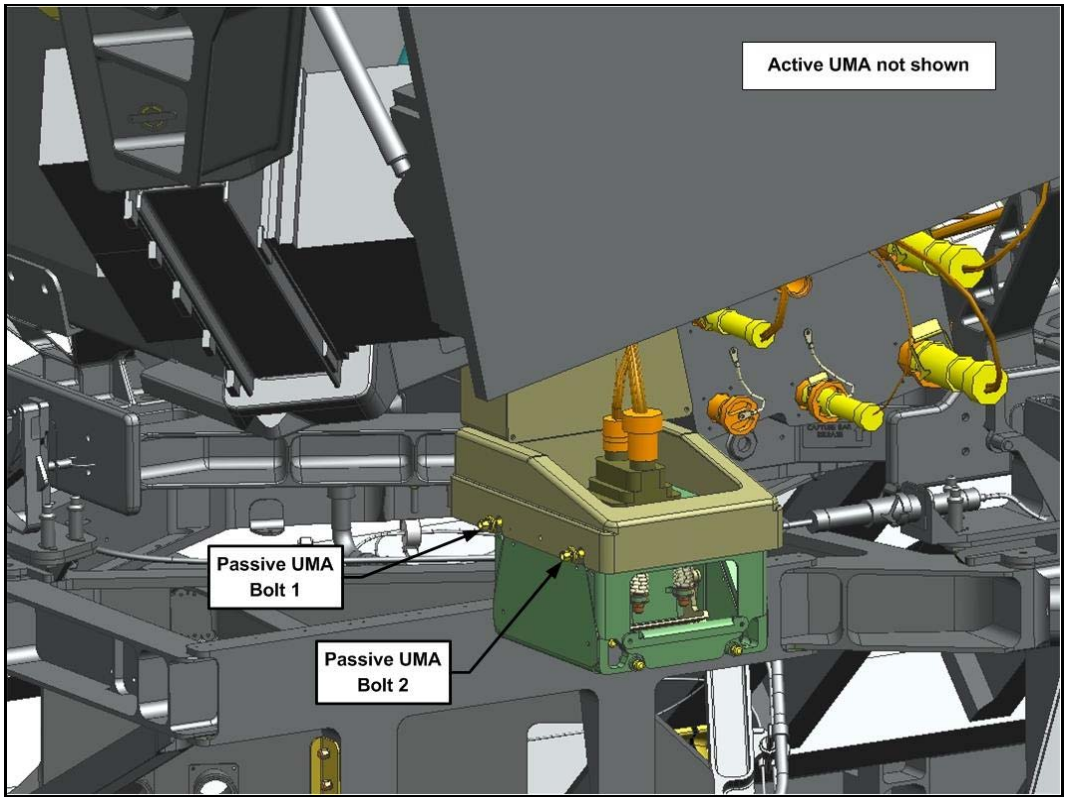
Active UMA Interfaces



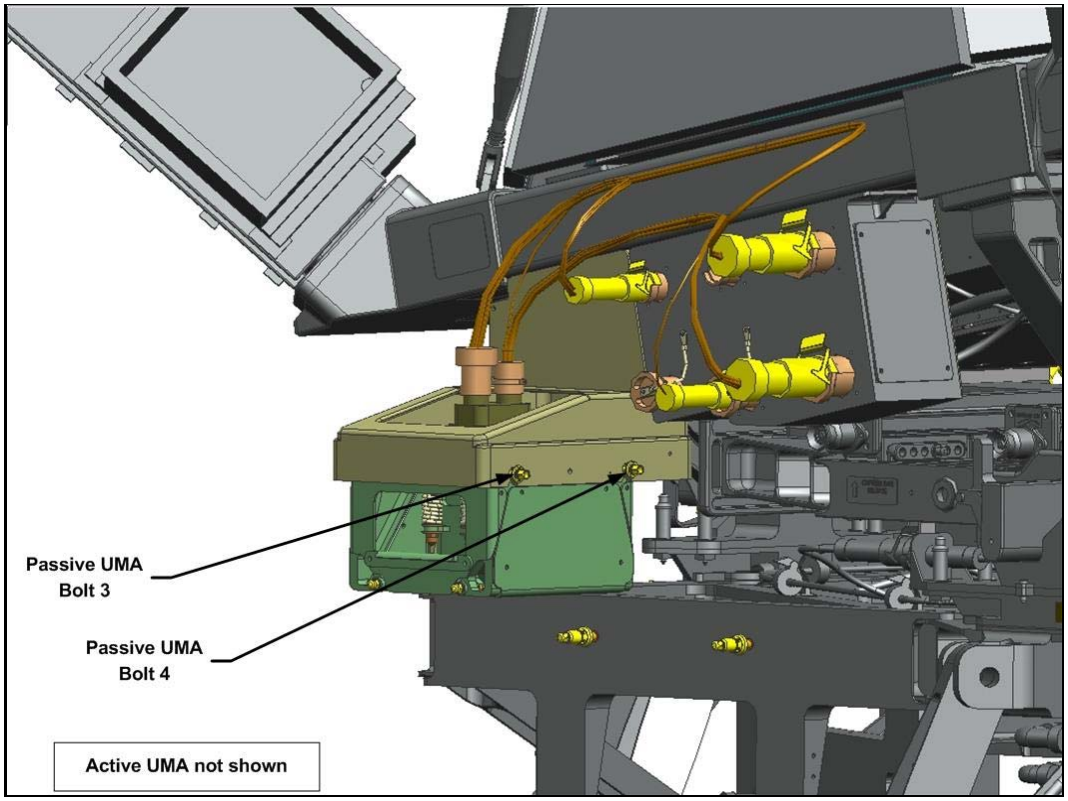
Active UMA Interfaces



Passive UMA Interfaces



Passive UMA Interfaces



Passive UMA Interfaces

Procedural Steps

Step 1

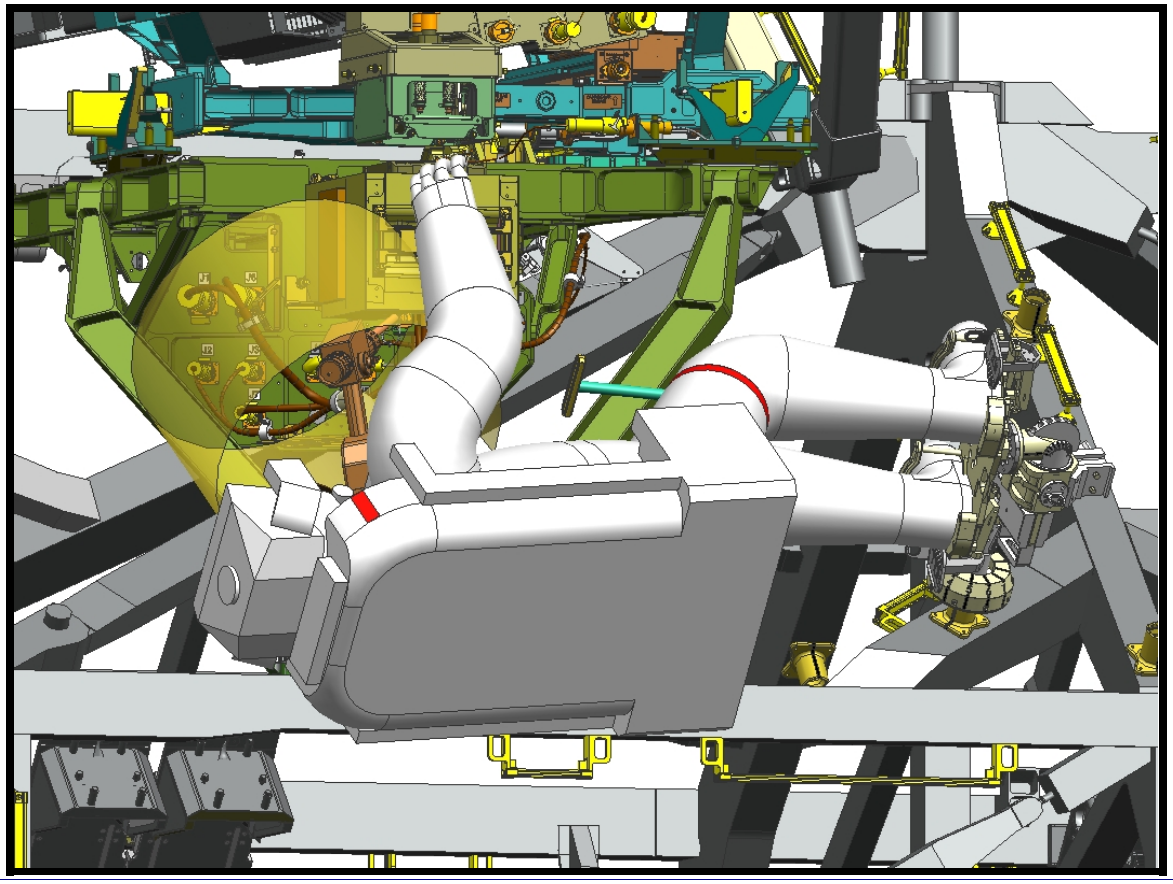
EV1 Actuate Active UMA EVA Override Bolt

Platform: WIF

Contingency Step

Actuate Active UMA EVA Override Bolt with Pistol Grip Tool (PGT) and 7/16" x 12" Socket Extension (Wobble) to demate the Active UMA from the Passive UMA.

Note: This step is required only if the Active and Passive UMAs do not demate remotely. Refer to Note 5.



Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
C	n/a	n/a	C	C	C	C	C	C	C	C	C	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 12" Socket Ext (Wobble)	SEG33106932-301	1
3023	APFR Installation	APFR Assy	SEG33106857-301	1
PAS	Stabilization	APFR Ingress Aid	SED39127050-301	1
		Pistol Grip Tool (PGT)	GE1557000	1

APFR		WSS	WIF Extender	CETA Cart	UG Data	
WIF:	S3/17-11	***Yaw:***	***Clock:***	***Loc:***	***SSRMS#:***	
Clock:	10:00 (300)	***Clock:***	***Pitch:***	***Arm Set:***	***MT#:***	
Pitch:	FF (+90)	***Pitch:***	***Length:***	***WIF Yaw:***	***MBS#:***	
Roll:	L (-90)	***Toolhead:***		***WIF Pitch:***	***CETA#:***	
Yaw:	12:00 (0/360)				***EV#:***	1

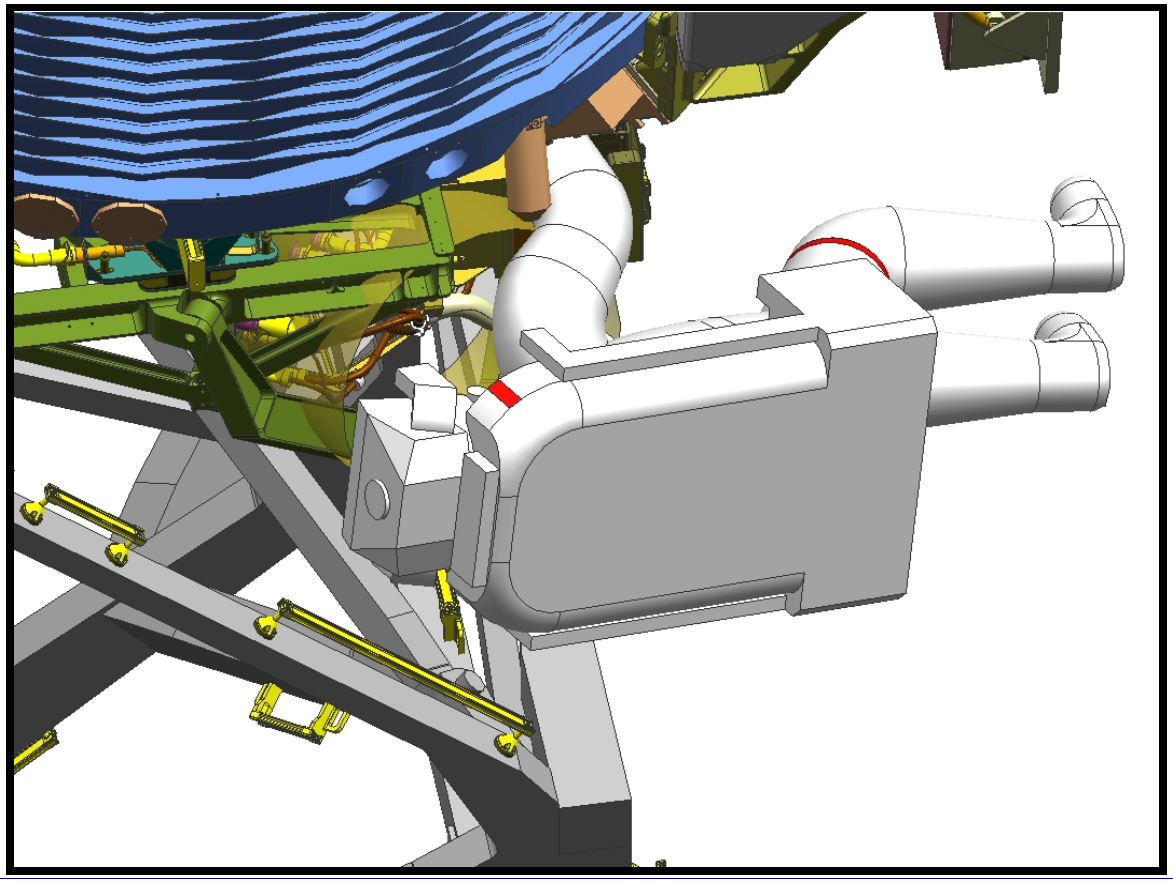
Step 2

EV1 Open Active UMA Clamps 1, 2 and 3

Platform: Free Float

Open Active UMA Clamps 1, 2 and 3.

Refer to Note 5.

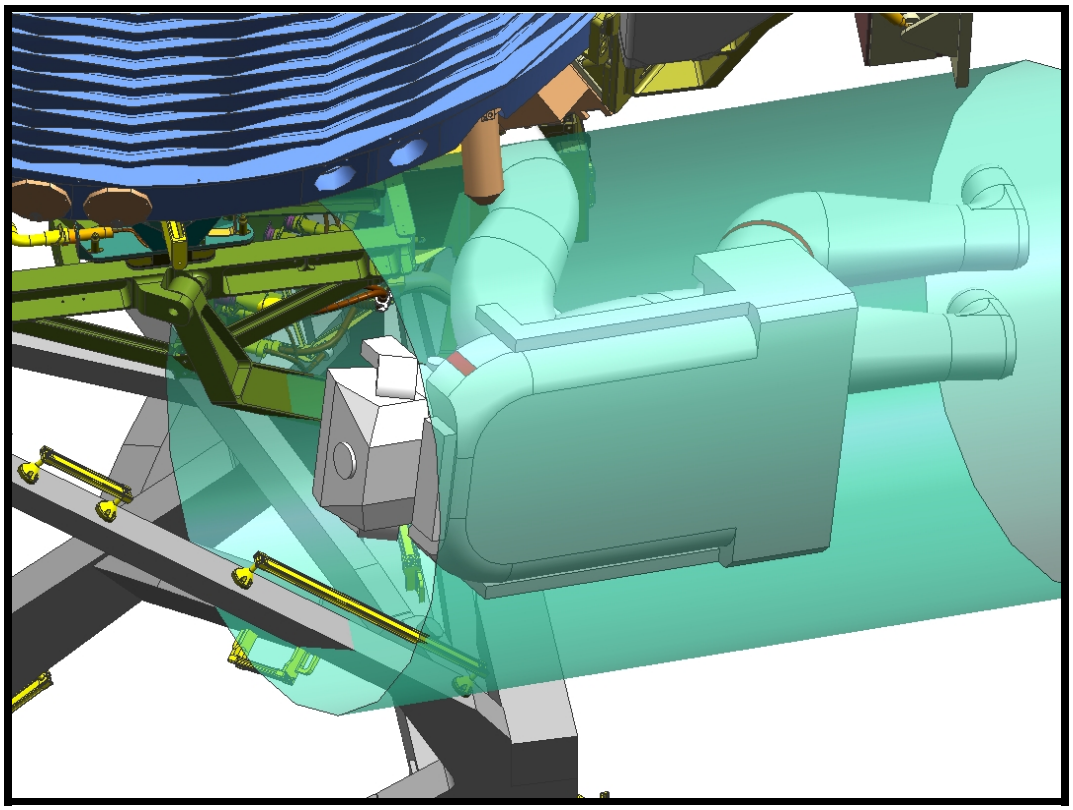


Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
n/a	C	n/a	n/a	C	Ce	C	n/a	n/a	n/a	C	C	n/a

Handrail/Handhold	Usage	Tool	Part Number	Quantity
PAS	Stabilization	None		

APFR	WSS	WIF Extender	CETA Cart	UG Data
WIF:	*Yaw:*	*Clock:*	*Loc:*	*SSRMS#:*
Clock:	*Clock:*	*Pitch:*	*Arm Set:*	*MT#:*
Pitch:	*Pitch:*	*Length:*	*WIF Yaw:*	*MBS#:*
Roll:	*Toolhead:*		*WIF Pitch:*	*CETA#:*
Yaw:				*EV#:* 2



48 inch Work Volume Non-Compliant: Envelope is violated by S3 structure and PAS. See Remarks section for the exception to this violation.

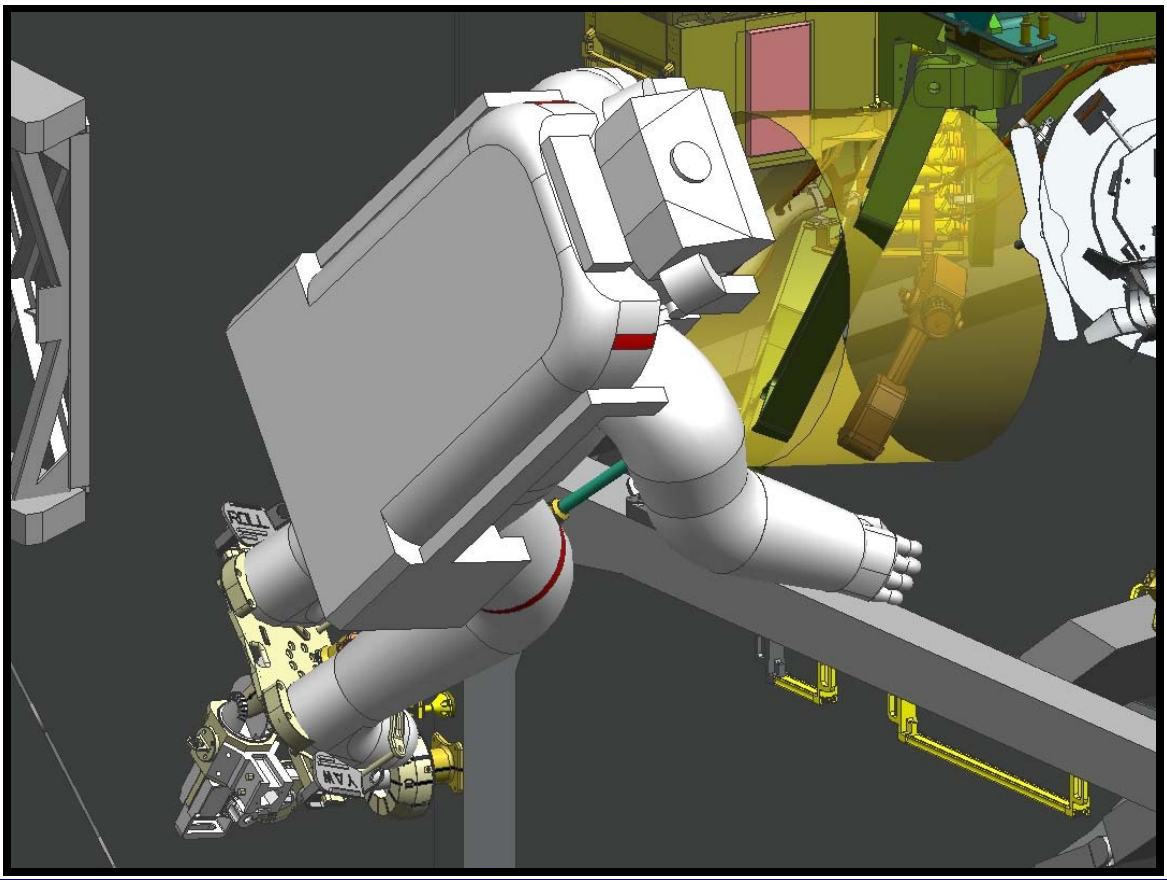
Step 3

EV1 Disengage Lower Bracket Bolt 1

Platform: WIF

Disengage Lower Bracket Bolt 1 with PGT, Right Angle Drive (RAD) and 7/16" x 2" Socket Extension.

Refer to Notes 3 and 5.

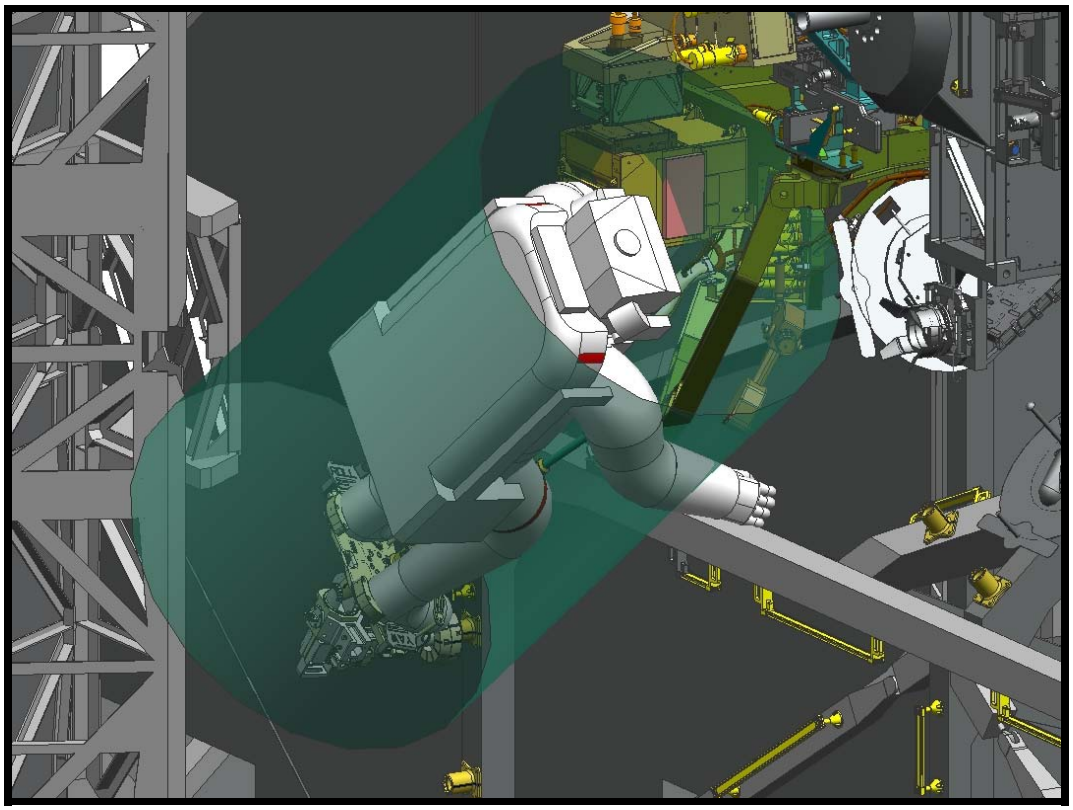


Step Requirement Assessment

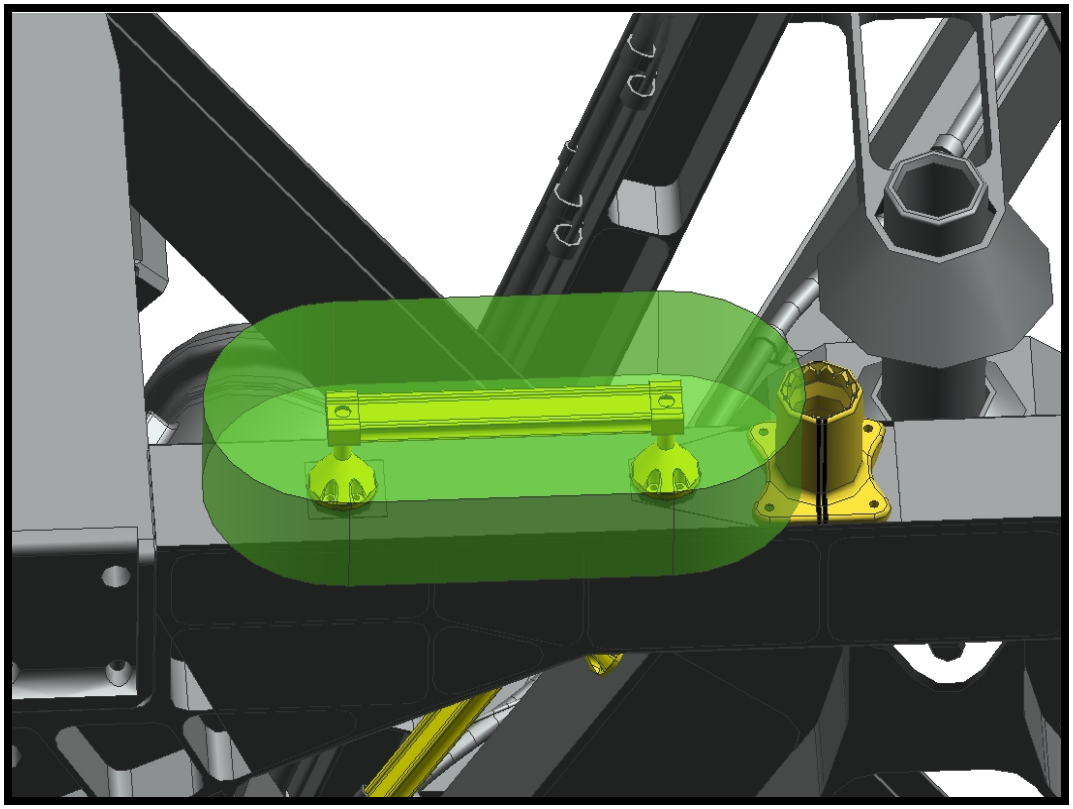
Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
C	n/a	n/a	C	C	Ce	C	C	C	C	C	Ce	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 2" Socket Ext (Rigid)	SEG33106930-301	1
3006	APFR Installation	APFR Assy	SEG33106857-301	1
PAS	Stabilization	APFR Ingress Aid	SED39127050-301	1
		Pistol Grip Tool (PGT)	GE1557000	1
		Right Angle Drive (RAD)	SEG33106925	1

APFR		WSS	WIF Extender	CETA Cart	UG Data	
WIF:	S3/17-02	***Yaw:***	***Clock:***	***Loc:***	***SSRMS#:***	
Clock:	10:00 (300)	***Clock:***	***Pitch:***	***Arm Set:***	***MT#:***	
Pitch:	QQ (-9)	***Pitch:***	***Length:***	***WIF Yaw:***	***MBS#:***	
Roll:	E (+18)	***Toolhead:***		***WIF Pitch:***	***CETA#:***	
Yaw:	12:00 (0/360)				***EV#:***	3



48-inch Work Volume Non-Compliant: Envelope Violated by Active UMA and S3 structure. See Remarks section for the exception to this violation.



Handrail Envelope Non-Compliant: Envelope of HR 3006 is violated by WIF 02. See Remarks section for the exception to this violation.

Step 4

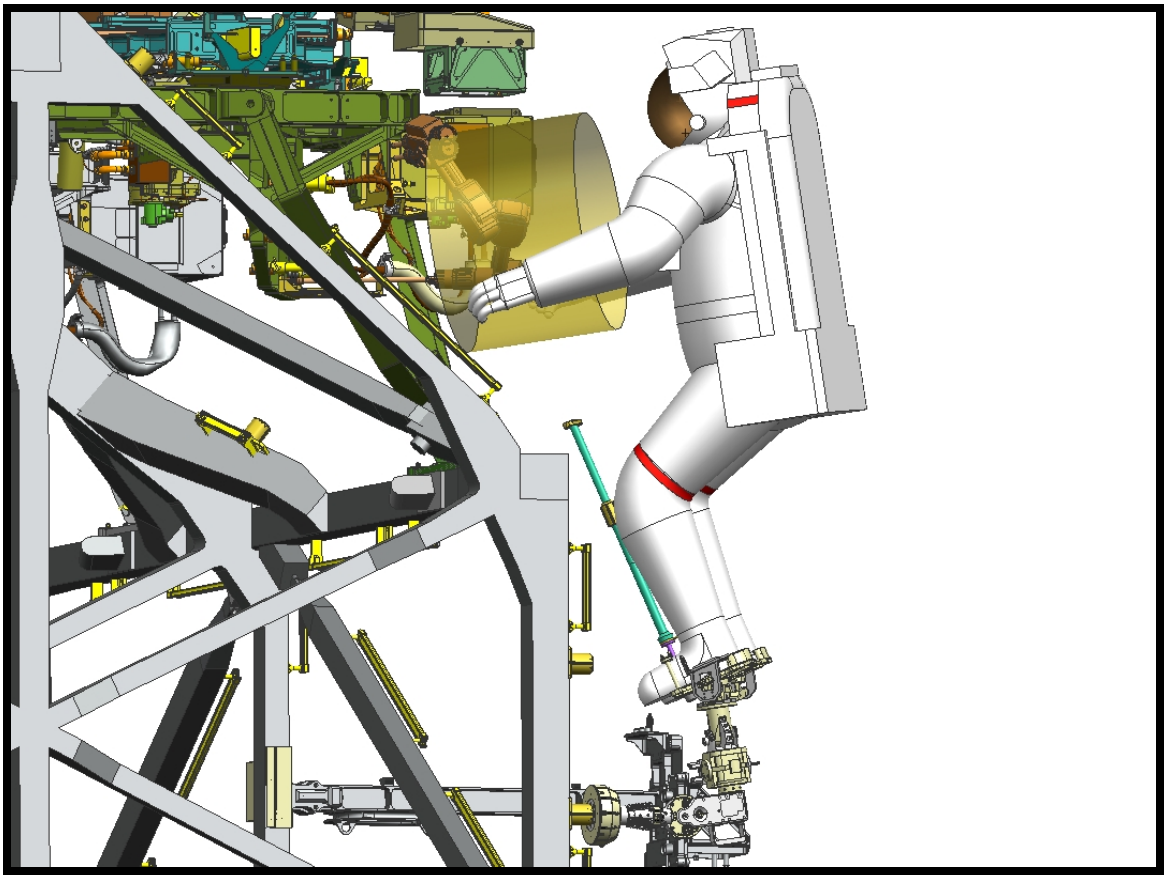
EV1 Remove Lower and Upper Brackets

Platform: WIF

Disengage Lower Bracket Bolt 2 with PGT and 7/16" x 18" Socket Extension. Remove Lower Bracket.

Disengage Upper Bracket Bolts 1 and 2 with PGT and 7/16" x 6" Socket Extension. Remove Upper Bracket.

Work Envelope is Non-Compliant because the Brackets are outside the envelope. Refer to Note 3.

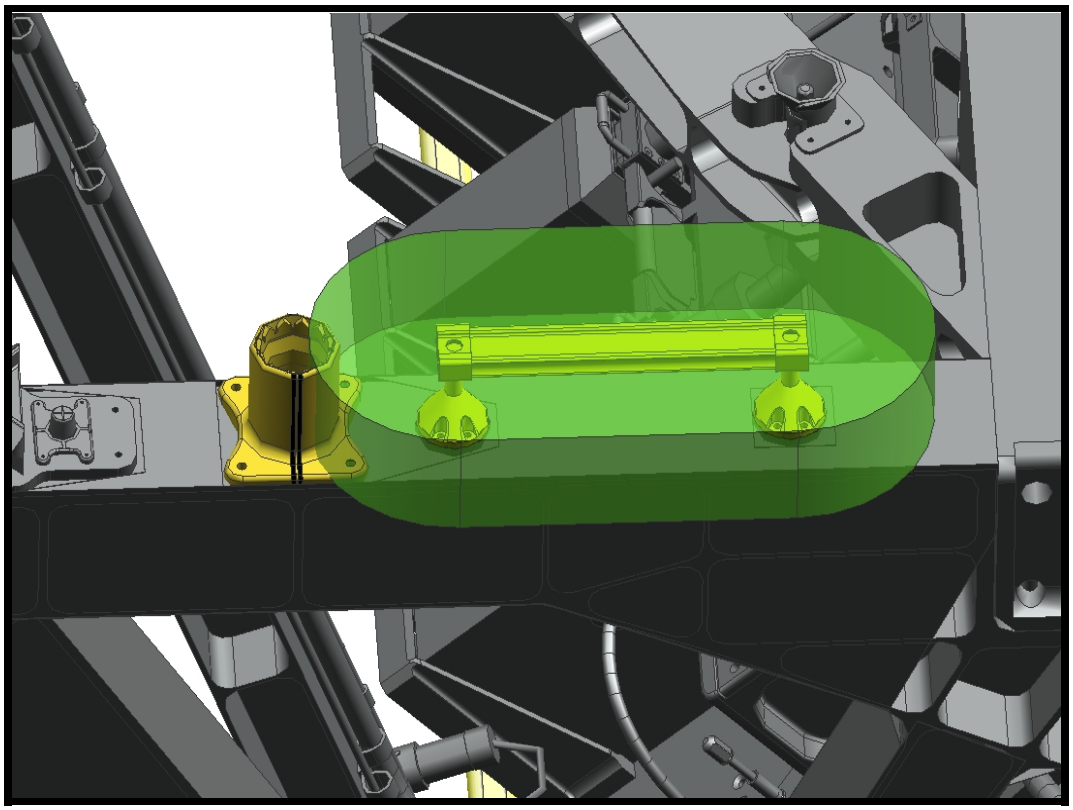


Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
C	n/a	n/a	Ce	C	C	C	C	C	C	C	Ce	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 18" Socket Ext (Wobble)	SEG33106933-301	1
3007	APFR Installation	7/16" x 6" Socket Ext (Wobble)	SEG33106931-301	1
3005	Stabilization	APFR Assy	SEG33106857-301	1
		APFR Ingress Aid	SED39127050-301	1
		Pistol Grip Tool (PGT)	GE1557000	1

APFR		WSS		WIF Extender		CETA Cart		UG Data	
WIF:	S3/17-03	***Yaw:***		***Clock:***		***Loc:***		***SSRMS#:***	
Clock:	9:00 (270)	***Clock:***		***Pitch:***		***Arm Set:***		***MT#:***	
Pitch:	QQ (-9)	***Pitch:***		***Length:***		***WIF Yaw:***		***MBS#:***	
Roll:	F (0)	***Toolhead:***				***WIF Pitch:***		***CETA#:***	
Yaw:	1:00 (30)							***EV#:***	4



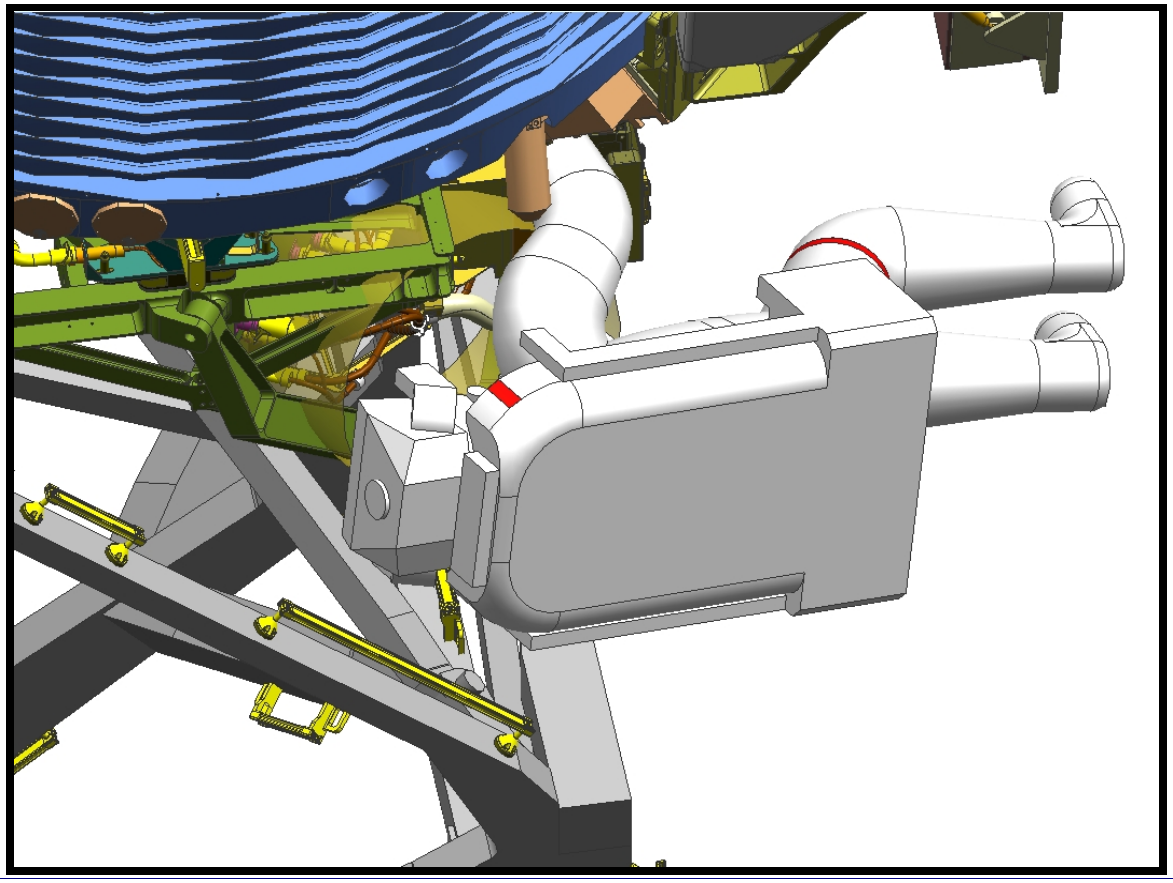
Handrail Envelope Non-Compliant: Envelope violated by WIF 03. See Remarks section for the exception to this violation.

Step 5

EV1 Demate Active UMA Connectors

Platform: Free Float

Demate Active UMA connectors from J1, J2, J3, J6, and J7 on connector panel.



Step Requirement Assessment

The Requirements for this step have been assessed in step 2 for EV1

Handrail/Handhold	Usage	Tool	Part Number	Quantity
PAS	Stabilization	None		

APFR	WSS	WIF Extender	CETA Cart	UG Data
WIF:	*Yaw:*	*Clock:*	*Loc:*	*SSRMS#:*
Clock:	*Clock:*	*Pitch:*	*Arm Set:*	*MT#:*
Pitch:	*Pitch:*	*Length:*	*WIF Yaw:*	*MBS#:*
Roll:	*Toolhead:*		*WIF Pitch:*	*CETA#:*
Yaw:				*EV#:* 2

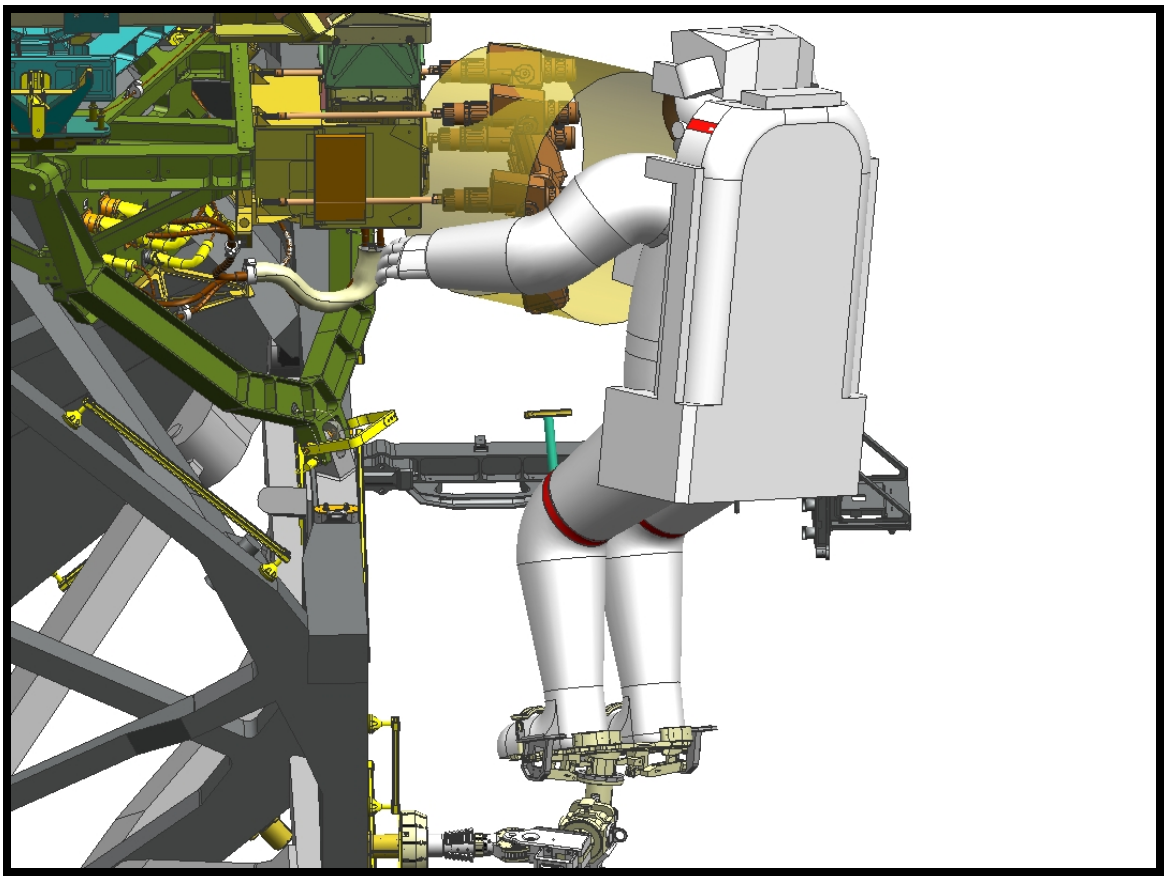
Step 6

EV1 Disengage Active UMA Bolts 1, 2, 3 and 4 and Remove Active UMA

Platform: WIF

Install Micro Conical Fixture (MCF) Scoop on UMA Microconical. Disengage Active UMA Bolts 1, 2, 3 and 4 with PGT and 7/16" x 18" Socket Extension. Remove Active UMA using the MCF Scoop.

Worksite Outfitting is Non-Compliant because the Stability Aid is Non-Compliant.
Handrail 3006 Non-Compliance is same as Step 3, EV1.

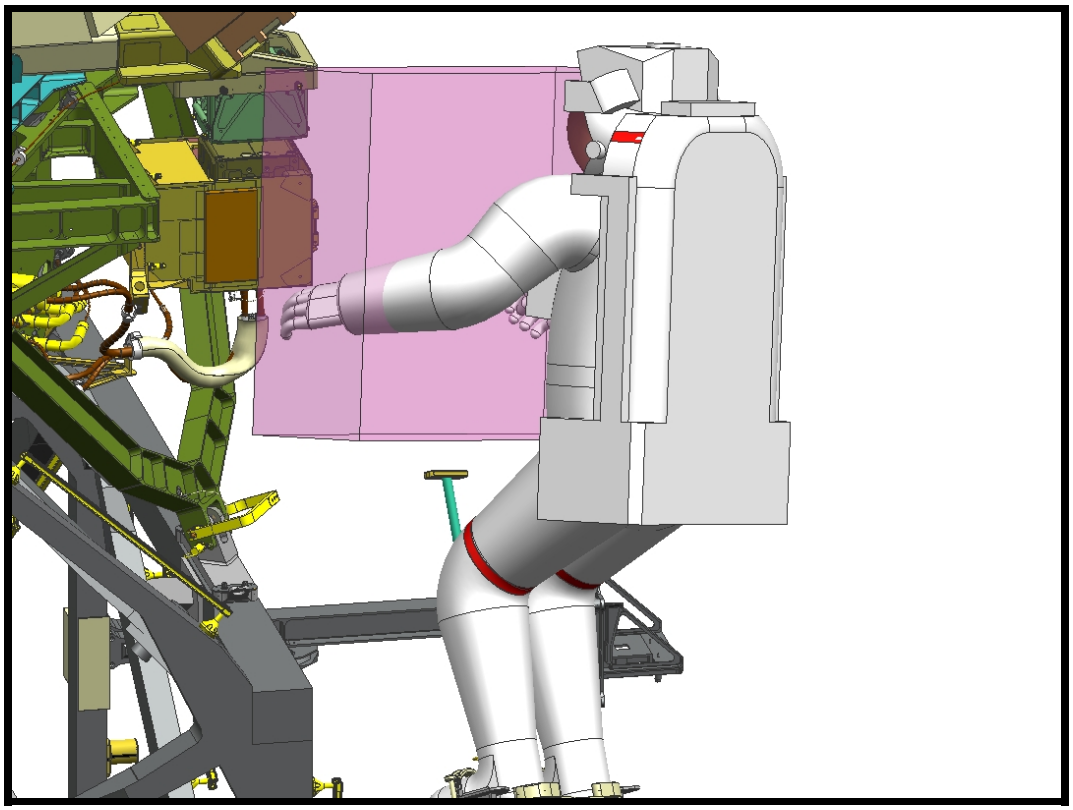


Step Requirement Assessment

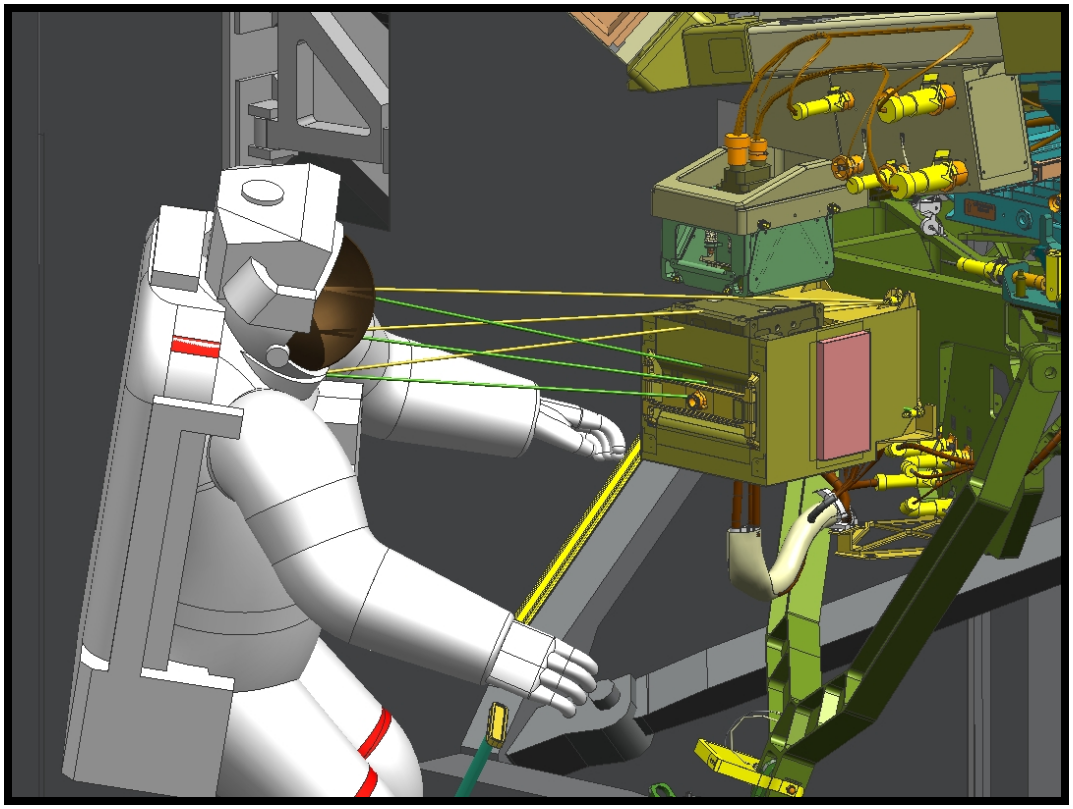
Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
Ce	n/a	n/a	C	Ce	C	C	C	C	Ce	C	Ce	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 18" Socket Ext (Wobble)	SEG33106933-301	1
3006	APFR Installation	APFR Assy	SEG33106857-301	1
		APFR Ingress Aid	SED39127050-301	1
		MCF Scoop, OHTS (Micro Conical)	SEG33107677-301	1
		Pistol Grip Tool (PGT)	GE1557000	1

APFR		WSS	WIF Extender	CETA Cart	UG Data	
WIF:	S3/17-02	***Yaw:***	***Clock:***	***Loc:***	***SSRMS#:***	
Clock:	12:00 (0/360)	***Clock:***	***Pitch:***	***Arm Set:***	***MT#:***	
Pitch:	NN (+18)	***Pitch:***	***Length:***	***WIF Yaw:***	***MBS#:***	
Roll:	K (-72)	***Toolhead:***		***WIF Pitch:***	***CETA#:***	
Yaw:	1:00 (30)				***EV#:***	5



Stability Aid Non-Compliant: There are no stability aids within the envelope. See Remarks section for the exception to this violation.



Field of View Non-Compliant: The Active UMA blocks the Field of View to the Active UMA Bolts 3 and 4. See Remarks section for the exception to this violation.

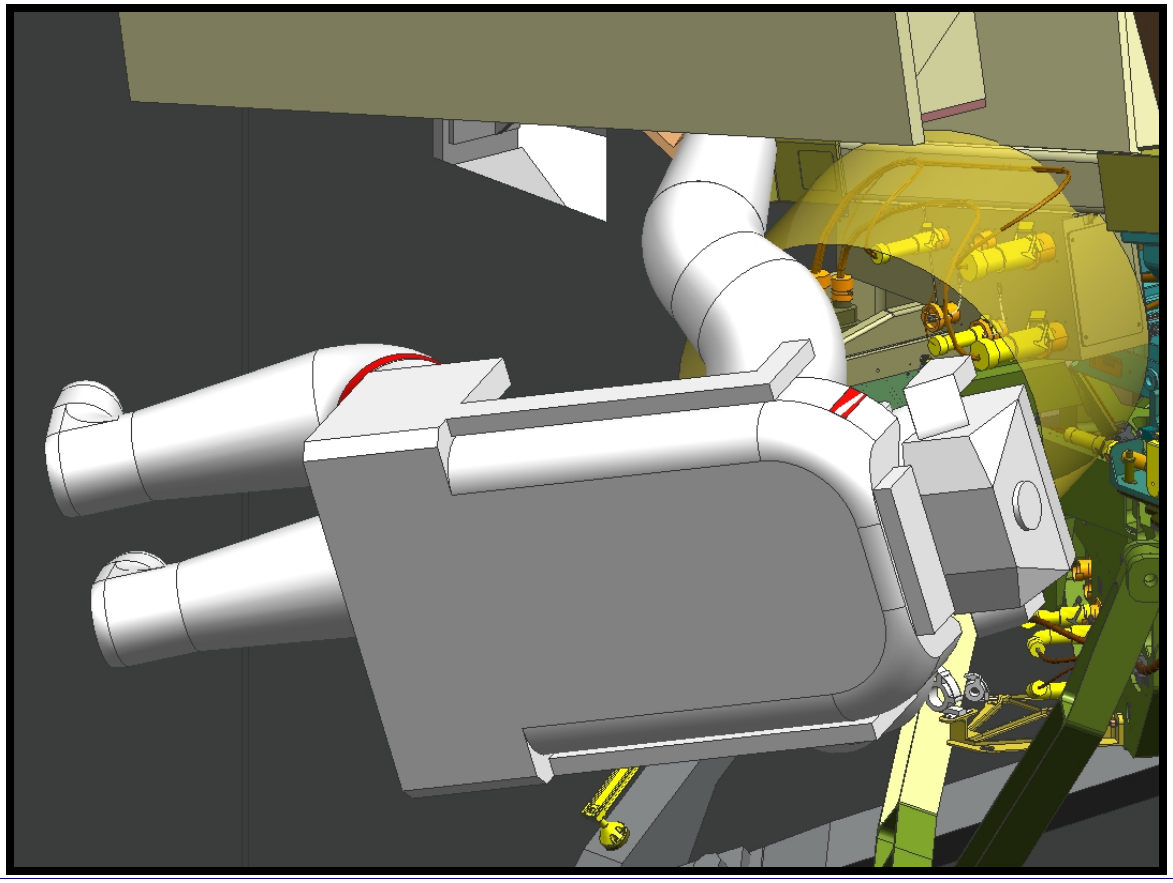
Step 7

EV1 Demate Passive UMA Connectors

Platform: Free Float

Demate Passive UMA Connectors from J103, J111, J112, J101B.

Refer to Note 5.



Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
n/a	C	n/a	n/a	C	C	C	n/a	n/a	n/a	C	C	n/a

Handrail/Handhold	Usage	Tool	Part Number	Quantity
PAS	Stabilization	None		

APFR	WSS	WIF Extender	CETA Cart	UG Data
WIF:	*Yaw:*	*Clock:*	*Loc:*	*SSRMS#:*
Clock:	*Clock:*	*Pitch:*	*Arm Set:*	*MT#:*
Pitch:	*Pitch:*	*Length:*	*WIF Yaw:*	*MBS#:*
Roll:	*Toolhead:*		*WIF Pitch:*	*CETA#:*
Yaw:				*EV#:* 6

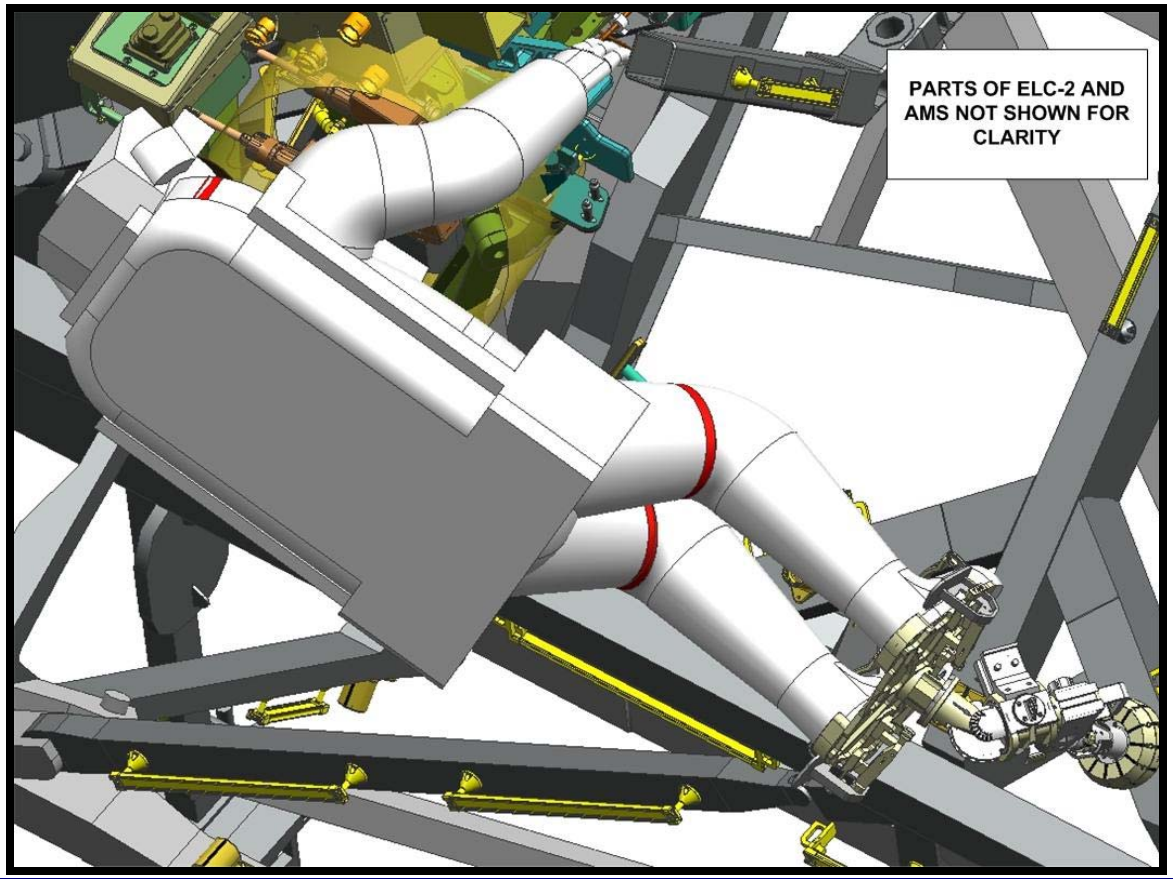
Step 8

EV1 Disengage Passive UMA Bolts 3 and 4

Platform: WIF

Disengage Passive UMA Bolts 3 and 4 with PGT and 7/16" x 6" Socket Extension.

Refer to Note 5.



Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
C	n/a	n/a	C	C	Ce	C	C	C	C	C	C	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 6" Socket Ext (Wobble)	SEG33106931-301	1
3040	APFR Installation	APFR Assy	SEG33106857-301	1
PAS	Stabilization	APFR Ingress Aid	SED39127050-301	1
		Pistol Grip Tool (PGT)	GE1557000	1

APFR

WIF:	S3/19-24
Clock:	12:00 (0/360)
Pitch:	KK (+45)
Roll:	C (+54)
Yaw:	2:00 (60)

WSS

Yaw:	
Clock:	
Pitch:	
Toolhead:	

WIF Extender

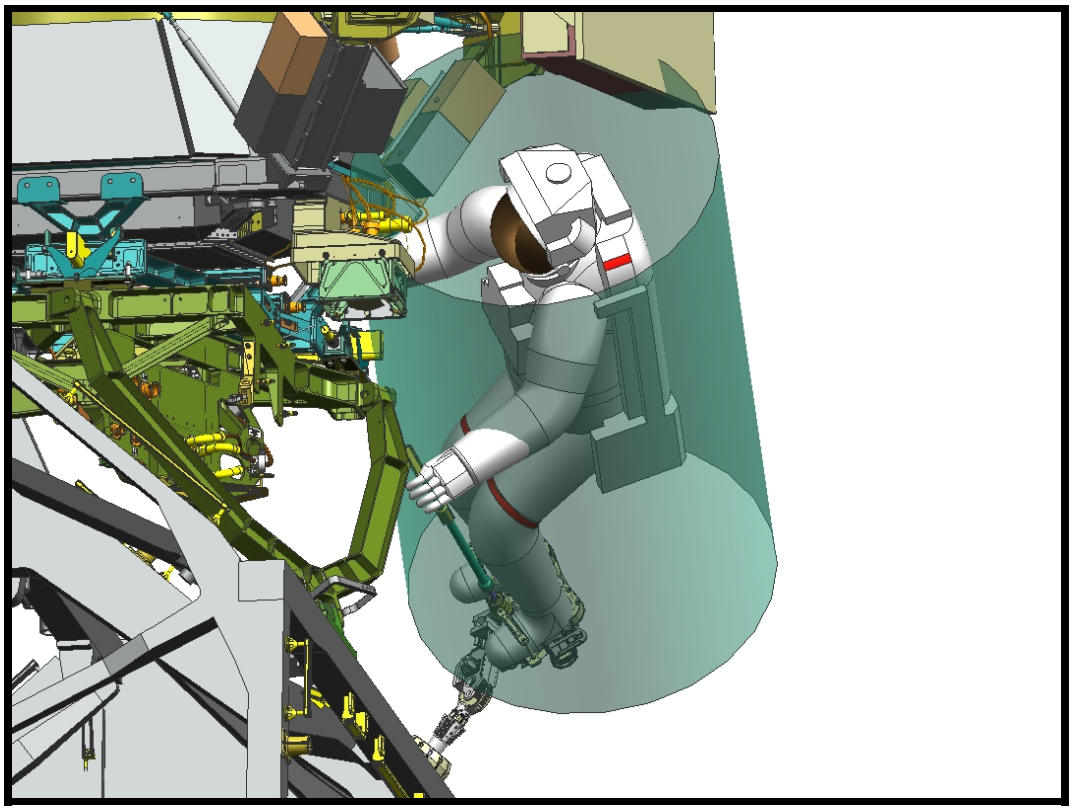
Clock:	
Pitch:	
Length:	

CETA Cart

Loc:	
Arm Set:	
WIF Yaw:	
WIF Pitch:	

UG Data

SSRMS#:	
MT#:	
MBS#:	
CETA#:	
EV#:	7



48 inch Work Volume Non-Compliant: Envelope is violated by the AMS. See Remarks section for the exception to this violation.

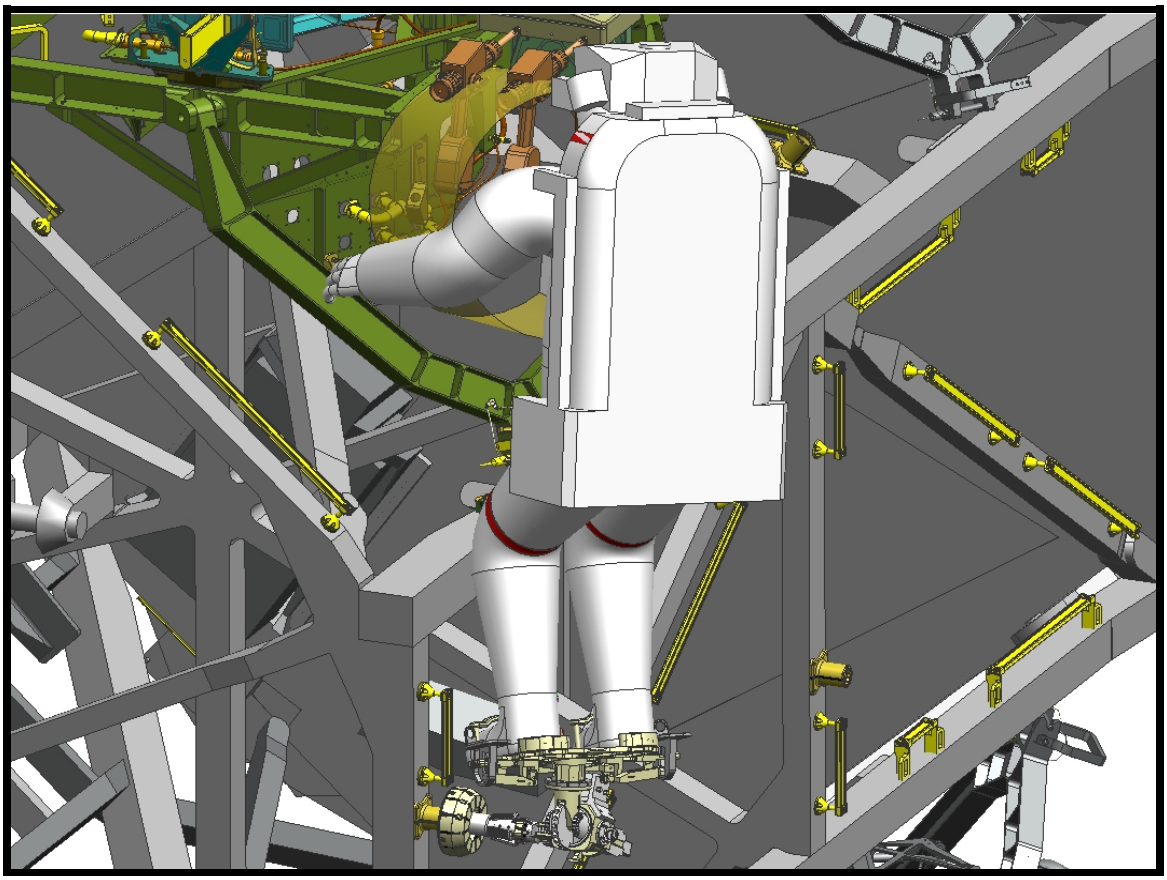
Step 9

EV1 Disengage Passive UMA Bolts 1 and 2 and Remove Passive UMA

Platform: WIF

Disengage Passive UMA Bolts 1 and 2 with PGT and 7/16" x 6" Socket Extension. Remove Passive UMA.

Worksite Outfitting is Non-Compliant because the Stability Aid is Non-Compliant.
Handrail 3006 Non-Compliance is same as Step 3, EV1.



Step Requirement Assessment

Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48" Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
Ce	n/a	n/a	C	C	C	C	C	C	Ce	C	Ce	C

Handrail/Handhold	Usage	Tool	Part Number	Quantity
APFR Ingress Aid	APFR Ingress	7/16" x 6" Socket Ext (Wobble)	SEG33106931-301	1
3006	APFR Installation	APFR Assy	SEG33106857-301	1
		APFR Ingress Aid	SED39127050-301	1
		Pistol Grip Tool (PGT)	GE1557000	1

APFR

WIF:	S3/17-02
Clock:	7:00 (210)
Pitch:	QQ (-9)
Roll:	B (+72)
Yaw:	1:00 (30)

WSS

Yaw:	
Clock:	
Pitch:	
Toolhead:	

WIF Extender

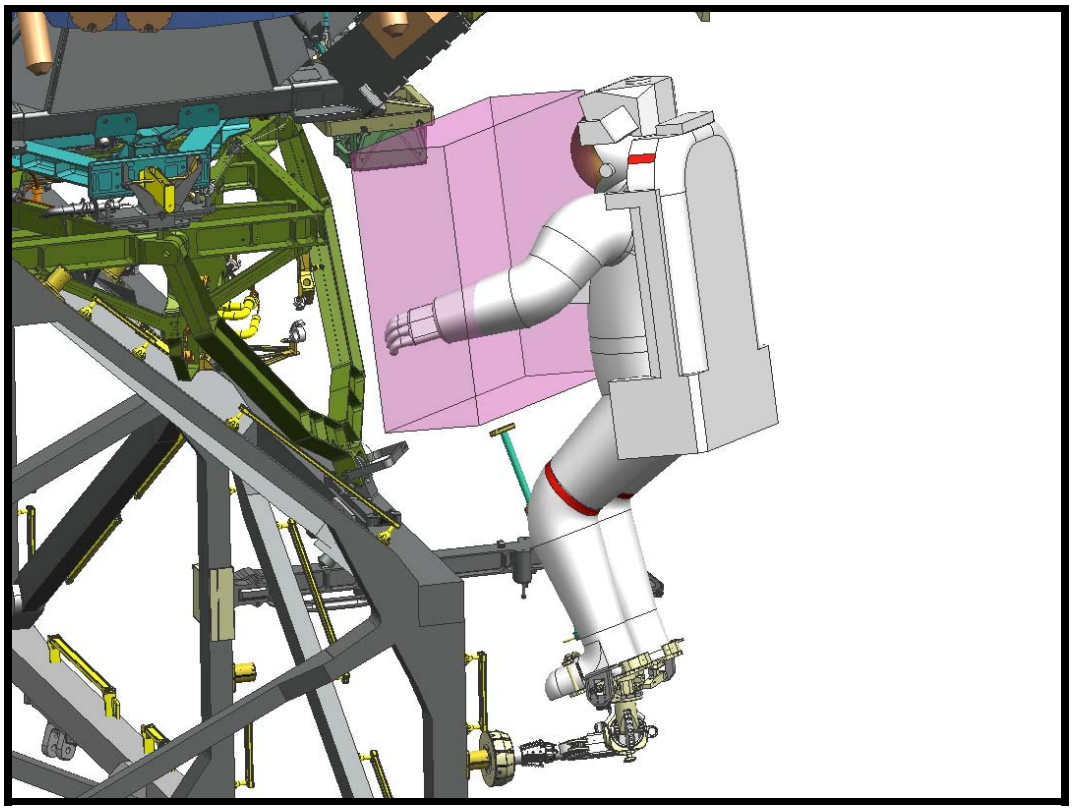
Clock:	
Pitch:	
Length:	

CETA Cart

Loc:	
Arm Set:	
WIF Yaw:	
WIF Pitch:	

UG Data

SSRMS#:	
MT#:	
MBS#:	
CETA#:	
EV#:	8



Stability Aid Non-Compliant: There are no stability aids within the stabilization envelope. See Remarks section for the exception to this violation.

Applicable Requirements

SP-M-229T	Prime Item Development Specification (PIDs) For S3
SSP30256H (Reference Only)	Extravehicular Activity (EVA) Standard Interface Control Document
SSP41162AY	Segment Specification for the United States On-Orbit
SSP50005E (Reference Only)	International Space Station Flight Crew Integration
SSP57003D	Attached Payload Hardware Interface Control Requirements Document

Requirement Paragraph Mapping

Document Number	Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48 Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
SP-M-229T	3.2.2.4.1.1	3.2.2.4.2	NF	3.3.7.2.1	3.3.7.2.2	3.3.7.2.3	3.3.7.2.6.1	3.3.7.2.6.2	3.3.7.2.6.3	3.3.7.2.6.4, 3.3.7.2.6.5	3.3.7.3.2	3.2.2.3.6	NF
SSP30256H (Reference Only)	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	3.6.1.2.2	3.6.4.2.2
SSP41162AY	3.2.2.5bc, 4.3.2.2.5bc	3.2.2.5d, 4.3.2.2.5d	3.2.2.5g, 4.3.2.2.5g	3.3.7.7.1, 4.3.3.7.7.1	3.3.7.7.2, 4.3.3.7.7.2	3.3.7.7.3, 4.3.3.7.7.3	NF	3.2.2.5f, 4.3.2.2.5f	3.2.2.5f, 4.3.2.2.5f	3.2.2.5e, 4.3.2.2.5e	3.3.7.3b, 4.3.3.7.3b	NF	NF
SSP50005E (Reference Only)	NF	NF	NF	14.3.2.3.1a, 14.4.3.1	14.3.2.3.1b	14.3.2.3.1d	14.5.3.1g	NF	NF	14.5.3.2d	14.3.2.3.1c	NF	NF
SSP57003D	3.11.2.5.1, 3.11.2.5.2	3.11.2.7.1, 3.11.2.7.1.1, 3.11.2.7.1.2, 3.11.2.7.1.3	3.11.2.6.1.1, 3.11.2.6.1.2	3.11.2.1	3.11.2.2	3.11.2.3	3.11.3.1.3	3.11.3.1.7.3	3.11.3.1.7.4	3.11.3.1.7.1, 3.11.3.1.7.2	3.11.2.4	3.11.3.1.4.3	3.11.3.3.1

Compliance Matrix

Step	Crew Member	Worksite Outfitting	Free-Float Outfitting	RMS Outfitting	Work Envelope	Field of View	48 Work Volume	Mobility Aids	APFR Installation	APFR Ingress	Stability Aids	Glove Clearance	Handrail Envelope	WIF Envelope
1	EV1	C	n/a	n/a	C	C	C	C	C	C	C	C	C	C
2	EV1	n/a	C	n/a	n/a	C	Ce	C	n/a	n/a	n/a	C	C	n/a
3	EV1	C	n/a	n/a	C	C	Ce	C	C	C	C	C	Ce	C
4	EV1	C	n/a	n/a	Ce	C	C	C	C	C	C	C	Ce	C
6	EV1	Ce	n/a	n/a	C	Ce	C	C	C	C	Ce	C	Ce	C
7	EV1	n/a	C	n/a	n/a	C	C	C	n/a	n/a	n/a	C	C	n/a
8	EV1	C	n/a	n/a	C	C	Ce	C	C	C	C	C	C	C
9	EV1	Ce	n/a	n/a	C	C	C	C	C	C	Ce	C	Ce	C

Requirement Compliance Selections

AR	***Analysis Required***	***n/a***	***Not Applicable***	***NE***	***Not Evaluated***
C	***Compliant***	***NC***	***Non-Compliant***	***NF***	***Not Found***
Ce	***Compliant with Exception***				

Concluding Remarks

Handrails 3006 and 3007 were granted an exception at the EVA AIT on August 5, 1997 and the exception is noted in SP-M-229 paragraph B.3.2.2.3.6.

The following violations were granted an exception at the EVA AIT on Sept 4, 2008 and the exceptions are noted in BOE-00006_SSP57003, BOE-00007_SSP57003, BOE-00008_SSP57003 and BOE-000010_SSP57003.

Step 2:
48-inch Work Volume is Non-Compliant because the envelope is being violated by S3 structure and PAS.

Step 3:
48-inch Work Volume is Non-Compliant because the envelope is being violated by the Active UMA and S3 structure.

Step 4:
Work Envelope is Non-Compliant because the Brackets are outside the envelope.

Step 6:
Worksite Outfitting is Non-Compliant because Stability Aids is Non-Compliant.
Field of View is Non-Compliant because the Active UMA blocks the view to Bolts 3 and 4.
Stability Aids is Non-Compliant because there are not stability aids within the envelope.

Step 9:
Worksite Outfitting is Non-Compliant because Stability Aids is Non-Compliant.
Stability Aids is Non-Compliant because there are not stability aids within the envelope.

The following violation was granted an exception at the EVA AIT on Septeber 4, 2008 and the exception is noted in 57213-NA-0006:

Step 8:
48-inch Work Volume is Non-Compliant because the envelope is being violated by the AMS.

Appendix A: Acronyms and Abbreviations

3D	Three Dimensional
AIT	Analysis and Integration Team
AMS	Alpha Magnetic Spectrometer
APFR	Articulating Portable Foot Restraint
CAD	Computer Aided Design
CETA	Crew and Equipment Translation Assembly
CP	Camera Port
CSYS	Coordinate System
DQA	Document Quality Assurance
EAR	EVA Analysis Report
ELC	Express Logistics Carrier
ERU	Engineering Release Unit
ESP	External Stowage Platform
EV	Extravehicular Crewmember
EVA	Extravehicular Activity
EVA&CSI	Extravehicular Activity and Crew Systems Integration
EVAP	EVA Procedure
FPMU	Floating Potential Measurement Unit
ISS	International Space Station
MAGIK	Manipulator Analysis - Graphic, Interactive, Kinematic
MBS	Mobile Remote Servicer (MRS) Base System
MSER	Mechanical, Structural, Extravehicular Activity, & Robotic
MT	Mobile Transporter
NASA	National Aeronautics and Space Administration
PAS	Payload Attach System
PDS	Procedure Documentation System
PFR	Portable Foot Restraint
PGT	Pistol Grip Tool
PID	Prime Item Development
PPAS	Passive Payload Attach System
Pub.	Publish
R&R	Remove & Replace
Rev.	Revision
RMS	Remote Manipulator System
SRMS	Shuttle Remote Manipulator System
SSCN	Space Station Change Notice
SSP	Space Station Program
SSRMS	Space Station Remote Manipulator System
UCCAS	Unpressurized Cargo Carrier Attach System Assy
UG	Unigraphics
UMA	Umbilical Mechanism Assembly
WIF	Worksite Interface
WSS	Workstation Stanchion